DOCUMENT RESUME

ED 169 683 EA 011 604

AUTHOR Ryan, Doris W.; Schmidt, Martha
TITLE Mastery Learning: Theory, Research, and Implementation.
INSTITUTION Ontario Dept. of Education, Toronto.
PUB DATE 79
NOTE 169p.; Appendix may not reproduce clearly due to small print
AVAILABLE FROM Ontario Government Bookstore, 880 Bay Street, Toronto, Ontario, Canada M7A 1L2 ($2.50)

EDRS PRICE MF01/PC07 Plus Postage.
DESCRIPTORS Administrator Attitudes; Elementary Secondary Education; Foreign Countries; Group Instruction; Instructional Innovation; *Mastery Learning; Questionnaires; Teacher Attitudes; Teaching Methods
IDENTIFIERS Canada; *Chicago Mastery Learning Reading Program IL; *Mastery Learning in Social Studies Project SC

ABSTRACT

Mastery learning is a group-based, teacher-paced instructional strategy. Because it is also committed to criterion-referenced evaluation and to a strong emphasis on feedback and correctives throughout the learning experience, it is often confused with competency-based education, individualized instruction, and related innovations. Mastery learning depends on five basic components: formal specification of cognitive objectives, division of course content and objectives into instructional units, formative/diagnostic evaluation, corrective or remedial instruction, and criterion-referenced summative evaluation. A review of the research reveals that mastery learning significantly improves student acquisition of cognitive skills and reduces the variability in achievement within the group. Increased retention and transfer of learning and student attitudes are also indicated. Teachers and administrators using mastery learning strategies find the planning process demanding and recommend developing the process a unit at a time. This document discusses the theory, techniques, and implementation of mastery learning strategy; reviews the relevant literature; and discusses two programs in which the strategy has proved successful: the Chicago Mastery Learning Reading Program and the Camden, South Carolina, Mastery Learning in Social Studies Project. A substantial reference section and an extensive appendix (including sample units from the Chicago program) conclude the document. (Author/PD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED169683

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

MASTERY LEARNING: THEORY, RESEARCH, AND IMPLEMENTATION

DORIS W. RYAN, Principal Investigator
MARTHA SCHMIDT

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

B. Hildebrand

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

This research project
was funded under contract
by the Ministry of Education,
Ontario

EA 011 604

Ministry
of
Education
Ontario

© The Minister of Education, Ontario, 1979
Queen's Park
Toronto, Ontario

Printed by The Ontario Institute for Studies in Education

MINISTRY OF EDUCATION, ONTARIO CATALOGUING IN PUBLICATION DATA

Ryan, Doris, W.
Mastery learning: theory, research, and implementation/
Doris W. Ryan and Martha Schmidt.

This research project was funded under contract by the Ministry of Education, Ontario.

1. Learning, Psychology of. 2. Teaching. I. Schmidt, Martha.
II. Title

Additional Copies may be ordered from:

The Ontario Institute for Studies in Education
Publications Sales
252 Bloor Street West
Toronto, Ontario
M5S 1V6

or from:

The Ontario Government Bookstore
880 Bay Street
Toronto, Ontario
M7A 1L2

ON01136 153.15

1 2 3 4 5 XX 38 28 18 08 97

Summary

Mastery learning has become a "catch-word" for a number of current instructional and evaluative innovations. The strategy is often confused with competency-based education and with individualized instruction, probably because the system is committed to criterion-referenced evaluation and to a strong emphasis on feedback and correctives throughout the learning experience. Yet the group-based, teacher-paced model of mastery learning that has been developed by Block and Anderson (1975) is not the same. It is an integrated instructional system, a logical step-by-step method for creating a learning process in which most students can achieve at a high level.

This study discusses the theoretical bases for the mastery learning strategy, describes the strategy itself, summarizes the major research studies conducted to test its effectiveness, and presents the opinions and experiences of practitioners (teachers and principals) in implementation. Two specific implementation efforts--the Chicago Mastery Learning Reading Program and Pine Tree Hill School's Mastery Learning in Social Studies Project--are discussed in detail.

Mastery learning was developed from a theoretical model in which school learning was seen as a function of a student's opportunity to learn, perseverance, and aptitude (defined as time needed to learn), and in terms

of the quality of his/her instruction. The instructional strategy attempts to improve those factors under the direct control of teachers--namely, student opportunity to learn and the quality of instruction. There are six major components in the strategy: formal specification of cognitive objectives; division of course content (and objectives) into instructional units; formative/diagnostic evaluation; corrective or remedial instruction; and criterion-referenced summative evaluation. Each step is described and discussed in detail for the benefit of potential implementers.

The research review provides evidence that the mastery learning instructional strategy significantly improves student acquisition of cognitive skills and significantly reduces the amount of variability in achievement within a group of students. There is a limited but growing body of data that favor mastery learning from the standpoint of retention and transfer of learning and student attitudes toward themselves and toward the subject matter studied.

The planning process for teachers wanting to implement mastery learning is demanding. The teacher must assume the roles of curriculum planner, test developer, instructor, instructional designer, and classroom organizer. Because the planning for mastery teaching is so time-consuming, practitioners and researchers alike recommend a modest effort at initial implementation, e.g., attempting to develop a single unit as a start. Further, potential implementers would benefit from suggestions and even units developed elsewhere.

Ideally, many of the planning tasks could be done for teachers by school or board personnel assigned to these tasks. This was the development process used in the Chicago Mastery Learning Reading Program. As a result of the efforts of three full-time developers (plus five teachers in one school), a complete set of reading skills and comprehension units for grades 1-2 are now available. The materials have been tested, and the evaluation provides encouraging support in terms of improved student achievement. The program will now be implemented in the 500 elementary schools across the system, three years after its beginning. Implementation requires only one in-service meeting with teachers, and its cost is $13 per *class* per year.

Mastery learning, in summary, is a strategy that demands that more attention be paid to the impact of the school's instructional processes on student learning than to the impact of individual student differences on learning. When such a supportive instructional system is provided, the school has a potential for realizing the strategy's objective that most students can learn all that the school has to teach. The study report attempts to provide a resource book for teachers and administrators who want to understand the system and its implementation requirements.

Contents

1 Introduction/*1*

2 An Overview of Mastery Learning: The Theory and the Instructional Strategy/*15*

3 Overview of Mastery Learning Research/*39*

4 Implementing Mastery Learning: Experiences of Practitioners/*58*

5 The Chicago Mastery Learning Reading Program/*70*

6 Implementing Mastery Learning in Social Studies: One School's Report/*86*

References/*101*

Appendices

Appendix A: Features of Experimental Research/*107*

Appendix B: Questionnaire and Covering Letter/*109*

Appendix C: Tables from Survey Data/*113*

Appendix D: Samples of Units from the Chicago Mastery Learning Reading Program/*117*

List of Tables

1 A Summary of General Types of Correctives/*30*

2 Studies Reported in the Present Review/*42*

3 Effect of Corrective Treatment on Student Mastery/*52*

4 Number of Students Mastering Summative Tests/*97*

5 Z-Scores for Differences Between Expected and Actual Mean Scale Scores on the Social Studies Subtest of the Stanford Achievement Test/*98*

6 Z-Scores for Differences Between Expected and Actual Mean Raw Scores on the Social Studies Subtest of the Stanford Early School Achievement Test (Form A)/*98*

A1 Features of Experimental Research for which Reports were Available/*107/108*

A2 Features of Experimental Research Gathered From Secondary Sources/*109*

C1 Areas from which Responses Came/*113*

C2 Positions Held by Respondents/*113*

C3 Respondents' Years of Experience with Mastery Learning/*113*

C4 Subjects and Grades Taught by the Respondents Using Mastery Learning/*114*

C5 Responses to Question: "Who Made the Decision to Introduce Mastery Learning into Your Class/School/School System?"/*114*

C6 Amount of Time Required to Prepare Curriculum/*115*

C7 The Most Difficult Aspect of Mastery Learning/*115*

8

C8 Methods and Materials used in the Correctives Process/*115*

C9 Time Required to Cover Course Content, Relative to Previous Approach/*116*

1 Introduction

Between the years 1966 to 1968, the principal investigator was a doctoral student at the University of Chicago. At that time, John Carroll's paper, "A Model of School Learning" (1963), was required reading for students in educational psychology. We were aware that one of our most distinguished professors, Benjamin Bloom, was conducting pilot work in which he was attempting to build upon Carroll's model by providing extra time and help to slower learners. Bloom was also engaged, as I recall it, in conducting tutorial sessions with college students in which he taught them how to study and prepare for examinations. From insights gained in these exploratory efforts, Bloom's mastery learning strategy began to develop. By the time I left Chicago for O.I.S.E., Bloom had published his first article on the mastery strategy, after which the educational community gradually became aware of this emerging and revolutionary system.

In those days, my perception is that most of us believed Bloom to be working on a model of individualized instruction. With the possible exception of students doing a thesis under Bloom's supervision, we were unaware that his mastery strategy eventually would be designed primarily for group instruction. Furthermore, most of us had internalized the concept of individual differences (e.g., there are "slow" learners and "fast" learners; there are "good" learners and "poor" learners). We were influenced heavily by Bloom's own book, *Stability and Change in Human Characteristics* (1964), into believing that, unless the school could intervene very early in a youngster's life, there was little hope of changing an unsatisfactory learning pattern at later stages.

Those were the days in which much attention was paid by the educational community, especially in the United States, to developing compensatory programs for pupils from "educationally disadvantaged" backgrounds. Kindergartens, junior kindergartens, "head start" programs, and Federal grants of various kinds to various levels of the educational organization appeared. Little did any of us dream in the late 1960's that Bloom's work ultimately would lead to a theory questioning most of our developmental and experiential assumptions about individual differences and school learning.

The 1960's and early 1970's were also years in which numerous other innovations were introduced into North American educational systems. Most of these new programs enjoyed only brief life spans, and Ontario education during that period made its own contributions to the "heavily populated innovation graveyard," as Dolan (1977-78) has called it. While the introduction of these innovations might provide some basis for arguing that schooling had become more "humane," by the mid-1970's the general public had begun to argue strongly that these changes had promoted a "softer" education system in which less and less was required of students. The concern shifted from the so-called "disadvantaged" student to the "average" student, and the public began to demand evidence of student competencies.

During the period of escalation of innovative programs, the mastery learning protagonists worked slowly but steadily to test the effectiveness of their instructional strategy. Almost without exception, their researches provided evidence that mastery instructional strategies improved learning for the large majority of students exposed to them. As research evidence continued to pile up, educators could no longer dismiss the system as a "fad" or lightly dismiss the theory behind the system. Further, the strategy provided a means of addressing the mid-1970's concern about student competencies. Currently, large U.S. school systems, such as Chicago, Detroit, and Los Angeles, are moving toward implementation. Unlike other innovations, then, mastery learning is not only still with us, it is more alive than ever.

My observations over the past year or so suggest that, instead of expressing cynicism about mastery learning, a great many administrators are claiming to have implemented the system. Such claims, in my view, are based upon the apparent (but not necessarily real) similarity between mastery learning and a host of other innovations--individualized learning programs, development of behavioral objectives, movement toward criterion-referenced evaluation, and the emergence of standards of accountability. For example, around half of the states in the U.S. currently have legislation that mandates evidence of student competencies as a prerequisite for high school graduation. In the case of each of these efforts, it is assumed widely that mastery learning strategies are employed by teachers in their day-to-day instruction. Despite its compatibility with these efforts, however, mastery learning, I have discovered, is more than any one of them. As I now understand it, mastery learning as a philosophy and as an *integrated* system of instruction has not been implemented widely on a system-wide or even a school-wide basis.

Furthermore, many of the teachers in my classes at O.I.S.E. and at workshops have told me that they and their colleagues have *always* used mastery learning strategies in their classrooms. I believe their faulty perceptions, like mine initially, are due to a superficial understanding of the system and to the overt simplicity of the major steps in the process (i.e., group instruction supplemented by frequent feedback and individualized help to students who need it). Teachers seem to believe that they do these things; thus, they think they are using mastery strategies. Yet two years ago, when I asked a large group of graduating teacher-education students to raise their hands if they believed they could teach almost all their future students to read, not a single hand was raised. In discussion, it was clear that these new teachers, like their predecessors traditionally, were convinced about individual differences in native learning abilities and about the school's and the teacher's inability to compensate for such differences.

Ontario teachers, like most teachers around the world, have internalized the assumption that students differ greatly in their capacity to learn. They are not surprised, therefore, to find that there is enormous variation in student achievement in school. If teachers assume that such outcomes are to be expected, then parents and the general public cannot be expected to assume otherwise. Indeed, the back-to-the-basics plea is accompanied often by editorial comments such as "Perhaps school is not the place for all young people, especially in adolescence." In my opinion, the North American public is eager for "tougher" standards and a guarantee that *only* those pupils who have learned will pass or graduate, but they are not ready to accept without question an instructional system that claims that *all* students can and will learn. Teachers, teacher-educators, parents, and the general public will need a re-education and will demand proof that a system making such claims is not just another "soft" innovation with lowered standards.

Mastery learning strategies are based on a theoretical rationale that assumes that, given a supportive instructional system, 95 per cent of all students can learn all that the school has to teach, all at near the same mastery level. When the supportive instructional system is provided (i.e., mastery learning), Bloom is not surprised to find almost no variation in student achievement in school.

Mastery learning strategies, then, not only provide a means of *certifying* student competencies, but they also provide a means by which nearly all students *can achieve* those competencies. The strategies demand that more attention be paid to the impact of the school's instructional processes on student learning than to the impact of individual student differences on learning. I now appreciate the fact that mastery instructional strategies and their underlying theory are revolutionary since they question a basic assumption of teachers and lay people that individual differences are almost immutable by the schooling process.

For me personally, the theory is compelling. I have never forgotten a study in a United States city which revealed that students from wealthy suburban areas and those from inner-city "slums" entered grade 1 at a fairly similar level of reading readiness. By grade 6, the two groups of students were roughly eight grade levels apart in reading achievement. Students from the inner-city had actually experienced a *decline* in reading achievement levels across the elementary years, despite the fact that their schools had equally experienced and qualified teachers, more money per pupil, and smaller classes than did the suburban schools in the city. Mastery strategies appeared to me to offer a remedy for such situations. At the least, the study made me realize that schools do have an impact, although it may be negative for some students. Such a study also lends weight to Bloom's current argument that many individual differences are man-made.

My optimism about the strategy was based at first on a rather meager knowledge of how it worked in practice and of what it demanded of teachers. I felt more knowledgeable about related theoretical issues. During 1975, Tom Greenfield and I had worked on what was published as *The Class Size Question*, and we had developed a rationale for school effects on students.

In our rationale, a host of variables (such as school organization, class size, teacher qualifications, and the like) were seen as having only indirect impact on student outcomes, with the actual experiences of students in schools having direct impact. A similar rationale was used to interpret data for *The Education of Adolescents in Remote Areas of Ontario* (Ryan, 1976).

In the class size book, Greenfield and I gave as an example the fact that providing a well-equipped school library could not produce student learning; if the books were actually read, those experiences could indeed affect learning. I know now that, in mastery learning terminology, we were saying essentially that opportunity to learn (providing books) is necessary but not sufficient to produce learning. Time spent in learning (reading books) was another critical variable. In the remote area book, I argued that teachers needed to change instructional processes to improve the experiences of young people who entered the high school with inadequate elementary school backgrounds and with little time or opportunity for study outside of school. I recognized, then, that what goes on inside classrooms was the key to understanding the outcomes of schooling on students. At that time, I could not clarify, in an operational way, what we meant by "experiences" and what an ideal instructional process (or even an improved one) should contain.

I had been reading about the importance of time as a variable in school learning, especially the work of Harnischfeger and Wiley (1975). I was fortunate enough to discuss this work with David Wiley at an American Educational Research Association conference. Wiley told me that the work was being misunderstood and misinterpreted, that providing adequate time for students to learn was not the major element of his paradigm, and that the key variables involved the teacher's use of the curriculum and the actual instruction that the teacher provided.

In 1976, I was asked by the National Institute of Education to review a proposal for the implementation of competency-based education (CBE) in the state of Oregon. In researching for my review, I re-read a paper sent to me by Bill Spady (a former fellow student at Chicago, now at NIE) on the sociological implications of mastery learning (1974). This, in turn, stimulated me to read Block's book (1971) on mastery learning, the book by Block and Anderson (1975), and an article by Bloom in which he discussed curricular and instructional implications of the International Educational Assessment studies (1975). During late spring, I served on a consultant team with Jim Block (also a former fellow student at Chicago) in the Oregon CBE effort and was able to discuss his experiences with mastery learning implementation.

In 1977, Block suggested that I attend a workshop that he was conducting for teachers at Sharbot Lake High School in Ontario. Frontenac County's Director of Education, Reg Shadbolt (then Superintendent of Education) had contacted me earlier, asking for assistance in identifying high schools where mastery ideas had been implemented and informing me that Sharbot Lake High School had attempted to implement mastery ideas in their instructional program. Block had suggested my name as a potential resource person in implementation efforts (a role I felt unqualified to assume at that stage).

Several other directors of education, with whom I had discussed the mastery strategy, were interested in learning more about its potential and its feasible implementation. In short, interest was clearly evident in Ontario, the social climate (demanding greater attention to basic skills learning) was supportive, but I did not feel knowledgeable enough about, or experienced enough with, the strategy to provide information and assistance. Before attempting to encourage Ontario school administrators and teachers to implement mastery learning, I wanted to understand the system fully, to see it work in practice, and to identify constraints and facilitators in implementation. Thus, I sought and was granted funding from the Ontario Ministry of Education to conduct a study and review. My intention was to produce a report that would be of practical use to Ontario school personnel.

Study Terms and Procedures

I thought that it would be optimum to document and analyze the implementation of mastery learning in an Ontario school. Sharbot Lake High School was the only school in Ontario, to my knowledge, in which such an implementation process was occurring. Thus, I originally proposed to focus on the process in that setting, supplemented with reviews of the literature and documentation of implementation efforts in the United States.

The subsequent scope of the funded contract reflected these early intentions. We were to describe and document the implementation in a particular Ontario secondary school, evaluate the effectiveness of the implementation, analyze the constraints and facilitations to implementation, describe the changes in instructional strategies and behaviors, and describe the effects on students and teachers as the result of introducing mastery learning. Finally, we were to document some of the implementation programs for mastery learning found at the elementary school level.

The procedures that we developed for the case study included initial interviews with teachers, administrators, and students, classroom observations, and questionnaires to students and teachers. We also intended to attempt to identify a means of evaluating student progress under pre- and post-mastery learning implementation. The former procedures were carried out; the latter proved unfeasible and irrelevant, given what we learned from the other data.

The present report does not include a detailed analysis of the Sharbot Lake study. For the reasons discussed below, we decided that this present report should focus on implementation efforts that had followed more closely the model proposed by Block and Anderson (1975). While that model is discussed in detail in Chapter 2 of this report, it may be useful here to summarize briefly the major steps in the system:

Steps 1-3: Pre-Planning

1. Teachers set course objectives, write summative (term) tests, and set mastery levels.
2. Teachers divide the course into instructional units (usually covering about two weeks), set unit objectives, write formative (unit) tests which are *not* to be used in student evaluation but rather in diagnosing learning errors, and they set a level of mastery by which to identify students needing extra time *and* instruction.
3. Teachers plan and develop initial instruction and initial student activities. They also plan and develop correctives (additional instruction and student activities for those who may need them).

Step 4: Teaching, Testing

4. Teachers provide instruction and involve students in the learning process for a unit. At the end of the period of instruction (usually not longer than two weeks), a formative/ diagnostic test is given. *All students write this at one time* and the results are not used to evaluate students, but rather to help the teacher decide what reteaching is needed.

Steps 5 and 6: Reteaching, Possible Retesting

5. Immediately following the formative test analysis, students are directed (under teacher guidance *in the classroom*) to:
   (a) enrichment activities (for those who have mastered);
   (b) remedial or corrective activities (for those who have not mastered).
6. The teacher decides when the class as a whole should move to the next unit. This decision is taken on the basis of the progress of students during the corrective process. (For *some* subjects, it may be necessary to re-administer a formative test to provide evidence that students are ready to progress to the next unit. This would be appropriate for courses such as maths in which the learning of one unit is *essential* for the learning of another. For other subjects, it may be sufficient to provide a few days of additional instruction and practice to students before moving on.) *Note* that students are *not* to rewrite formative tests whenever they wish; the tests are a part of the system and occur in the sequence noted here.

Step 7: New Cycle

7. The teacher begins instruction on a new unit, and the cycle (steps 4-6) begins again.

Step 8: Summative Testing

8. At the end of the term or course, a summative test (which was written to evaluate mastery of the objectives set in step 1) is given. Students are evaluated on the basis of *this test*, and their marks correspond with achievement levels set *prior* to the instruction of the first unit in the term.

A survey was designed and was sent to practitioners in Canada and the United States who had experience in mastery learning. As we shall see, the Canadian educators had "individualized" the model. A few sites, in which implementation had followed the group-based, teacher-paced model described above, were visited by the principal investigator. We also attempted to collect reports, materials, and research articles that would be resources for potential implementers.

The Sharbot Lake Case

After our first interviews in Sharbot Lake were analyzed, we found that the school had not implemented mastery learning fully, nor did the principal and staff claim to have done so. Rather, they had been working toward eventual implementation of the system for all courses and all grade levels--a massive undertaking that obviously would require time. Our data indicate that, to date, most staff members have put enormous time into curriculum development--setting course objectives, breaking the course into units, developing unit objectives, and developing unit curricular materials. We found many of their unit materials to be excellent.

On the instructional side, however, the changes they have implemented so far seemed much more appropriate to individualized instruction than to the group-based mastery learning system that we wished to study. In most courses, students were free to write unit tests at any point after instruction or as often as they needed in order to indicate mastery. We found very few cases of the actual use of tests as diagnostic services, followed by in-class correctives, *before* the entire class moved to the next unit. Some students, we were told, procrastinated and put off writing the tests for all or several units until the end of the term. This kind of procrastination was exactly what mastery strategists proposed to avoid by having teachers oversee student learning and relearning.

Further, the school had modified the mastery strategy to have core and scholarship objectives. Supposedly, a student had to achieve mastery of the core objectives before moving on to scholarship objectives. How teachers actually operationalized the distinction in terms of classroom activities, however, varied. There seemed to be no established pattern for determining student marks, in the sense of weights assigned to core vs. scholarship, for example. The reporting forms used in the school showed only a student's mark and achievement (A=80-100%;

B=60-79%; C=50-59%; I=Incomplete). Nothing on the reporting form was worded in terms of mastery of particular objectives, either core or scholarship. Thus it was not feasible to sort out student progress under mastery strategies. Given the fact that the instructional process generally did not reflect those strategies, it would also have been an invalid evaluation.

Constraints and Facilitators

The Sharbot Lake case is a good one in the sense of helping to identify constraints to implementation, which can be understood more readily by the reader after having read the discussion in Chapters 2, 4-6. None of the comments above are intended to be derogatory to the staff of Sharbot Lake. They had tried to do too much, too fast. They had also been influenced heavily by individualized instruction techniques prior to attempting to implement mastery learning, or so it seemed to us. They *have* done an admirable job of preparing their curriculum for initial instruction. They have taken an important first step, and the work put into that step should serve as a reality factor to other schools: the planning process is time-consuming and demanding, especially if teachers have to do this themselves.

From what I know now about mastery learning implementation, I would conclude that it is always more difficult to implement the strategy in a secondary than in an elementary school. This is especially true if the strategy has not been used in the feeder elementary schools. One of the major problems at the secondary level is that students enter with an enormous range of prior achievement levels and of prior affective experiences in a subject area. (These are the kinds of "entry behaviors" that Bloom's theory (1976) addresses; see Chapter 2.) In his address to teachers at Sharbot Lake High School, Block (1977b) cautioned:

> You can't make up for (learning) errors overnight. By the time a student gets to high school, the kind of change I'm talking about won't come about in two weeks . . . . It will take longer to get the slower ones up to the A standard.

Block, however, maintained that *if* testing and correctives were part of the instructional process in the class, and *if* teachers took whatever time was needed on early units to bring most students up to mastery, then student progress would be "substantial" in about 10 weeks and "really substantial" by the end of a year. The teachers who actively and consistently provided in-class opportunities for students to work on identified learning errors were not only sure to have a cognitive impact but also an affective impact on the student's attitude toward the subject matter and toward himself or herself (i.e., self-concept). These changes, Block argued, would begin to be seen in much shorter corrective times required on later units.

This enormously challenging and demanding role for the teacher as instructional planner, not just curricular planner, must be viewed at once as the major constraint and the major facilitator to implementation. As a constraint, teachers may be tempted to allow students more *time* to indicate mastery but may not be prepared to oversee the use of that time in class or to pre-plan alternative instructional activities and/or materials. It is interesting that, in our survey of practitioners, all our Canadian respondents were working at the secondary level, and all had implemented an "individualized" form of the mastery strategy. That is, time was varied, but it was primarily (almost exclusively) the student's responsibility to use the time he/she needed to meet the objectives.

The planning and use of a feedback-corrective process in the classroom itself, on the other hand, is the major facilitator of full and valid implementation. This process is the very heart of the mastery strategy in terms of potential impact on student learning. This is the stage in which students spend time correcting their learning errors that have been identified in the diagnostic unit tests. As we have noted, the process is also an implementation constraint in terms of its impact on the teacher's role.

The teacher's role, then, is a very demanding one under mastery learning. The role includes that of curriculum planner, test developer, instructor, instructional designer, and classroom organizer. We believe that Block is right in suggesting that teachers identify a block of time they are willing to devote to trying the strategy, and that they try to develop and use the entire process for a *single* unit. The motto is, "start small." The success they will likely enjoy will be a great motivator to try another unit in this way. This is appropriate if teachers are more or less "on their own" in implementing the strategy.

We believe, as do Block and Anderson (1975), that teachers will need to build on what is already available by way of curricular and instructional materials. They will, in our judgment, find many, many more curricular materials than instructional materials. Block and Anderson's handbook for teachers would be a good starting-point in identifying such existing sources of help.

Mastery learning units have been developed elsewhere and would also be of great help to teachers. Certainly the units developed as part of the Chicago Mastery Learning Reading Program would be of great value to elementary teachers. Indeed, the program has been designed to remove the teacher planning constraints. All a teacher has to do is *use* the materials provided, which include initial instruction, initial student activities, formative tests, and alternative student activities (correctives). (See Chapter 5)

The experience of the Pine Tree Hill School (South Carolina) in developing a mastery program for social studies would be of great help to teachers, not only in terms of the units they have developed there, but also in terms of the development process they have documented. In both the Chicago and the Pine Tree Hill cases, the development work arose from concerns regarding student achievement in the areas, respectively, of reading and social studies. In both cases, results in terms of student progress have been very encouraging.

In the ideal, we would argue that, where entire schools or systems wish to implement mastery learning, administrators at least make such materials available or that they assign a curricular-instructional planning task to a small group as a major activity. Probably a full year of lead time to develop units *and* correctives is important if the strategy is to produce student outcomes of the type found in mastery studies. Those outcomes surely are worth such efforts.

As we shall see, the Chicago program requires very minimal teacher in-service or out-of-class work, yet the results of implementation are very impressive. The cost to the board has been minimal as well, and it will likely be recovered with profit when the unit materials are available for sale. The South Carolina effort described in Chapter 6 provides an example of one school's attempt to implement in a single subject area. That program also had a coordinator to oversee curricular and instructional development; its funding came from a Federal grant.

The principal investigator has become, as a result of this study, a convinced but cautious enthusiast. I am convinced that mastery instruction, if implemented validly, will produce enormous improvements in student learning.

Of all the evidence supportive of mastery learning that we collected in this study, the outcomes of the Chicago Mastery Learning Reading Program's experimental implementation were the most convincing. The program was field-tested in Raymond Elementary School, Chicago, and the evaluation (comparing the mastery-taught students at Raymond with control groups) was very encouraging. By coincidence, I had worked on a teacher in-service project at the Raymond School during my doctoral student years. At that time, Raymond's pupils ranked lowest in the city on achievement tests. This was the school to which I referred in my 1973 article on "Improving Teacher-Principal Relationships." My own experiences in that school make me view the improvement in student reading levels under mastery learning as an indication that schools and teachers can have a noticeable effect on student progress, despite initial differences in student abilities and prior achievements. I now understand why Bloom's work is viewed as the most optimistic development in education during this century.

I am cautious, nevertheless, because I know that valid implementation is not as simple as it appears in theory. Teachers will need much help. We have collected various reference sources, including a sample of a teacher in-service program for training in mastery instructional strategies. It is our hope that the report that follows will increase the interest now present in Ontario and that we will begin to have implementation efforts in Ontario elementary schools in the near future. Just as the study has helped to re-educate the principal investigator, perhaps the report can do the same for others.

Organization of the Report

The theoretical rationale for mastery learning is presented in Chapter 2, together with a detailed description of the strategy in practice. We also include a brief discussion of the theory of human characteristics and school learning that was derived by Bloom from mastery studies. Chapter 3 presents a summary and discussion of research studies done at the elementary and secondary levels. The results of our survey of practicing educators who have used mastery learning are discussed in Chapter 4. The Chicago Mastery Learning Reading Program is described in Chapter 5, and an implementation effort in an elementary school in South Carolina is presented in Chapter 6.

2 An Overview of Mastery Learning: The Theory and the Instructional Strategy

In 1968, Benjamin Bloom first published a paper about an emerging instructional strategy that he called learning for mastery. At that time, evidence to support the usefulness of the strategy was meager and consisted primarily of small experimental studies conducted by Bloom and his students at the University of Chicago. The strategy arose from a theoretical paper on school learning (Carroll, 1963), but it was refined from the experiences of Bloom and his colleagues (many of whom, like James Block and Loren Anderson, were former students) as they continued pilot efforts over the following decade. It is probably fair to say that researchers such as Block and Anderson have been more interested in the application of the instructional system in schools, while Bloom has continued to focus as well on the refinement of a theory of school learning as a foundation for the strategy.

By 1976, Bloom had amassed findings from national and international studies in 25 nations as well as from a series of laboratory and classroom studies. His book, *Human Characteristics and School Learning*, presented a theory that attempts to explain individual differences in school learning and to determine the ways in which such differences may be altered. The book has been praised by reviewers as the most important book of this century "because it can change the ways in which we have traditionally viewed teaching and learning in school" (Harvey and Horton, 1977, p. 189). Essentially, Bloom argues that many individual differences in school learning are man-made and accidental rather than fixed in the individual at the time of conception. His major conclusion is, "What any person in the world can learn, almost all persons can learn *if* provided with appropriate prior and current conditions of learning" (Bloom, 1976).

A distinction must be made between Bloom's current theory and his mastery learning instructional strategy. The strategy itself was developed first, and it was intended to be consistent at that time with Carroll's (1963) theoretical model of school learning. As Bloom and his colleagues experimented with design and implementation of the instructional strategy, their findings not only provided support for the underlying theoretical model but also included some unanticipated consequences. These serendipitous findings, along with a review of other relevant research, led Bloom to question seriously the traditionally accepted theories of human development and human characteristics and the theories of school learning that flow from the former. Bloom's own theory, then, is still speculative and requires direct testing and elaboration in future educational research. Indeed, Bloom himself suggests directions for future research in several chapters of his book. The mastery learning strategy, in contrast, has been refined and tested on a much broader scope than Bloom's original laboratory-type studies. The research evidence presented in Chapter 3 demonstrates the success of such strategies.

Because the instructional strategy and Bloom's new theory are congruent, we discuss both from a conceptual point of view in this chapter. Basically, the effort in writing this chapter has been directed toward ensuring that the educational community fully understands the original theoretical underpinnings of the mastery learning strategy itself. From that understanding, one can then begin to appreciate the logic of Bloom's derived theory. Our major concern, nevertheless, is with the strategy rather than the theory.

Unlike many innovative learning strategies developed during the 1960's, mastery learning has continued to enjoy strong support. Its progress has been characterized by a "slow accretion of basic and applied research" (Dolan, 1977-78, p. 1), and it is supported both by advocates of basic skill learning and by proponents of affective and humanistic concerns. Nevertheless, some confusion has been created, as noted in the introductory chapter, because many current instructional and evaluative strategies use the rubric of mastery learning. It is important then, to communicate to the Ontario educational community more precisely what mastery learning is and what it requires by way of implementation.

Mastery learning is *not* the same, for example, as competency-based education (CBE), although it *could* be used (and, in the principal investigator's view, *ought* to be used) appropriately alongside CBE. Competency-based education is essentially an administratively imposed (or legislatively imposed) system of certifying that students have demonstrated attainment of a set of defined competencies. The system makes no assumptions about the proportion of students who *can* attain these competencies. Without benefit of an altered instructional system, therefore, CBE's impact is only upon assessment and evaluation processes. Ryan (1976) criticized Oregon's plan for CBE on these grounds, noting that the onus could fall even more heavily on the student under such an accountability system.

Mastery learning, in contrast, is an integrated system of instruction that includes not only procedures for identifying desired learning outcomes and for evaluation, but also (and most importantly) the process of instruction that will enhance student learning of those outcomes. The system starts with the assumption and expectation that around 85 to 90 per cent of the pupils can achieve at a predetermined level of mastery. The recommended level is that formerly designated as an "A" level, attainable under "normal" instructional processes by only around 20 per cent of the students. The onus, then, falls very heavily upon the teacher. While CBE can be implemented by fiat and by more refined processes of specifying desired outcomes and evaluating student achievement, mastery learning strategies can only be implemented by teachers in their daily classroom planning, organization, activities, and interactions with students.

Spady and Mitchell (1977) argued that mastery learning ideas should lie at the heart of the CBE efforts if CBE is to realize its promise; yet Block (1977a, 1978) noted that this is not the case in most CBE efforts across the United States. The Chicago public school system is a case in point. For several years, Chicago schools have supposedly had a system of mastery learning. Curricular objectives had been established for use across the system, reporting forms had been modified in accordance with the objectives, and teachers indicated on the report forms when a student had mastered each relevant objective. Chicago also has had continuous progress rather than age-grading for some time. Nevertheless, it was only with the experimental introduction of the Chicago Mastery Learning Reading Program three years ago that

Chicago actually experienced a mastery learning *instructional* system. What they previously had called mastery learning was really a form of student certification. Beginning next fall, the mastery learning reading program will be implemented across the system. (See Chapter 5 for more discussion of the program.)

Mastery learning strategy is also *not* the same as individualized instruction, although it is compatible with many of the principles of the latter. Individualized instruction attempts to build upon the theory that pupils learn at different rates and in different ways. The teacher's role is to allow differential amounts of time and a variety of ways to learn (including technological devices); in the ideal, the system is individual-based and student-paced. Block (in Brandt, 1976) has criticized approaches such as Individually Prescribed Instruction (IPI) on the grounds that students are exposed essentially to one kind of instruction, with time being the major variable. In his words, "If they (students) don't do well at certain points in the program, they're cycled back to the same old material presented in the same old ways under the assumption that all they need is more practice with the problematic material."

Mastery learning approaches, in contrast, are designed for use in the typical classroom situation and are generally implemented in a group-based, teacher-paced format. The strategies rely primarily on human beings, rather than technological devices; thus, implementation does not require substantial financial input for staff, equipment, or instructional materials (Dolan, 1977-78). Rather, the teacher must plan and use feedback (formative tests) and corrective procedures. The latter, correctives, may be individually prescribed, but they are essentially designed to re-present the material and/or reinvolve the student in learning the material in ways that differ from the original group-based instruction (Brandt, 1976). The group does *not* move on to new material until the corrective procedures have been experienced by members of the group who need them, at least in the model as developed by Block and Anderson (1975). Over time, as some research evidence has shown, differences in student learning rates diminish as students become more efficient in the sense of knowing how to learn and more confident that they can learn (Smith and Katims, 1977).

Theoretical Roots of Bloom's Original Mastery Learning Strategy

According to Bloom (1977a), when he began his career in the field of educational research and measurement, the prevailing view was that students' ability to learn followed a normal curve of distribution. That is, there were good learners and poor learners. Learning ability was regarded as a highly predictable characteristic and as a highly stable or permanent trait of the individual. Thus, school achievement could be closely predicted by an intelligence or aptitude test, and learning differences found early in the students' school careers would be present throughout those careers and throughout the remainder of their lives. Bloom himself, in *Stability and Change in Human Characteristics* (1964), reported longitudinal studies that revealed a very high correlation (about +.85) between measures of school achievement at grades 3 and 11 for the same individuals.

Bloom began to question this construct, since acceptance of it meant that there was little or nothing that schools could do except "weed out and eliminate the poorer learners while encouraging the better learners to get as much education as possible." Since it was also assumed that only the good learners could learn the complex and abstract ideas in a school subject, this construct led to streaming practices, grading practices, selective systems of education, guidance practices, and even to the careers and occupations made available to individuals. Bloom argues, "Most school systems in the world are based on it and school authorities, examining bodies, teachers, parents, and, finally, the student himself come to accept it" (1977a, p. 3).

Educational innovations in the 1960's typically sought not to question the concept of individual differences directly, but rather to attempt to modify schooling in accordance with that assumption. Since it was unclear whether the assumed differences in learning ability were caused primarily by genetic or environmental differences, there were innovations directed toward the latter. Thus, in the United States especially, many programs were developed as "compensatory" efforts, designed to give students from disadvantaged home environments a "head start" in school. Bloom himself spoke to such efforts in the 1965 book, *Compensatory Education for Cultural Deprivation.*

Another group of educational psychologists had begun to suggest that students differed, not so much in learning ability *per se*, but rather in terms of learning styles and learning rates. Thus, innovative programs of individualized instruction came on the scene. Many of these required the purchase of materials or technological devices; *all* required a degree of classroom management, diagnosis, and prescription for which teachers and traditional school organizations were ill-prepared (Ryan, 1972). Assumed differences in learning rates led to the introduction of continuous progress rather than age-grading as the basis for some school organizations.

Probably no theoretical treatment of the concept of differences in individual learning rates has received as much attention as has that of John Carroll (1963, 1965). Carroll did not question the concept of individual differences in student aptitude for a subject, but he argued that aptitude was essentially an index of the amount of time a student would require to learn a subject to a given level. It was *not* indicative of the level to which a student could learn. That is, if each student were allowed the time he/she needed to learn a subject to some criterion level, and if he/she spent the necessary time to do this, then he/she would probably attain that level. The time a student needed could be predicted from an aptitude test. If time to learn were held constant, only a few would learn. If time to learn were individually prescribed, then nearly all would learn, argued Carroll.

Further, Carroll believed that the time *spent* in learning and the time *needed* to learn were influenced not only by the characteristics of the student but also by the characteristics or quality of the instruction. From the simple equation:

$$\text{Degree of school learning} = f\left(\frac{\text{Time Spent}}{\text{Time Needed}}\right),$$

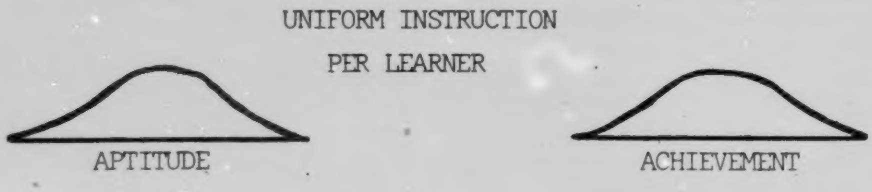
Carroll went on to elaborate upon the two major variables. "Time Spent" was seen to be determined by two factors: student perseverance and his/her opportunity to learn. The teacher obviously had some control over a student's opportunity to learn (the classroom time allotted to learning), if not on a student's perseverance (the time a student was willing to spend actively engaged in learning). Further, the "time a student needed" in order to learn was determined by three factors: a student's aptitude for the subject, the quality of his/her instruction, and his/her ability to understand the instruction. If the quality of instruction (a factor under the control of the teacher) were low, then the student would have difficulty understanding it and would need much additional learning time. Bloom (1977a) noted that it was originally anticipated that slower students might need as much as five times the amount of time required by the faster students.

Carroll's complete model of school learning can be represented as follows:

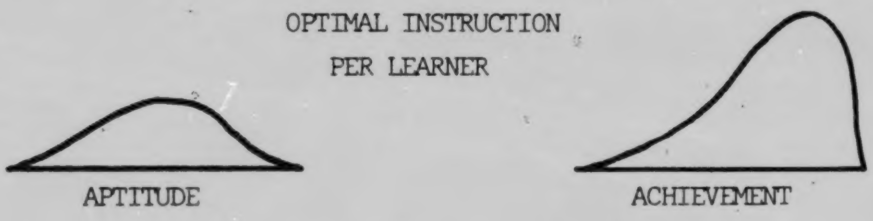
$$\text{Degree of school learning} = f\left(\frac{\text{Perseverance} + \text{Opportunity to learn}}{\text{Aptitude} + [\text{Quality of instruction} + \text{Ability to understand instruction}]}\right)$$

The brackets around "Quality of instruction + Ability to understand instruction" were meant to indicate not only their interactive nature, but also that aptitude *alone* would be the denominator in the equation under ideal instructional conditions. Aptitude itself was seen as determining the time required under such ideal conditions.

Since Carroll assumed that instructional conditions were *not* typically ideal, either for a class or for individuals in a class, degree of school learning was rarely a function of student characteristics alone. Indeed, he suggested strongly that individual students needed different kinds of instruction (including time or opportunity to learn, as well as differing instructional modes). Given uniform instruction and time, student aptitude should almost perfectly predict student achievement (see Bloom, 1977a). If aptitudes were normally distributed, then achievements would likewise be normally distributed:



If, on the other hand, the instruction and the time were adapted to each student's needs (as predicted by his/her aptitude), the achievement distribution would be highly skewed. Most of the students' scores would pile up on the high end of an achievement test, and the correlation between aptitude test scores and achievement scores would approximate 0 (rather than +.75 as they would under uniform instructional conditions).



Five years after Carroll's paper was published, Bloom had transformed the conceptual model into a working model for mastery learning. His logic, according to Block and Burns (1977), was that if aptitude predicted the time a student required to learn but not necessarily the level to which he/she could learn, it should be possible to fix the degree of school learning expected of each student at a *single* criterion level of mastery performance. Then, *if* the teacher attended to the variables under his/her control in Carroll's model (i.e., "opportunity to learn" and the "quality of instruction"), the teacher should be able to ensure that each student attained this level. In other words, Bloom sought to develop an instructional strategy in which individual differences in students' aptitude for the subject would have little bearing on their final achievement.

Bloom (1968) outlined methods by which the so-called slower learners could be given the extra time and help they needed. Originally, his design for a mastery learning strategy was intended to provide the extra time and help outside regular classroom schedules. The initial research primarily used this format in small pilot efforts by Bloom and some of his students, and their findings were highly supportive. However, it was found that the "slower" students did not need as much time and help as had been anticipated, as they became more successful with the learning of earlier tasks. It was apparent that the system could be designed for regular classroom use. It was clear from the history of tutoring that in every tutorial interaction there was some original instruction, some progress testing, and an effort by the tutor to vary instruction if the pupil had not learned. The problem was to replicate the tutorial model in a class of 30 or more students.

A Practical and Systematic Mastery Learning Format

Bloom's original outline of a mastery learning strategy has been modified, and today there are many versions of it. The refinement and elaboration that appears to the principal investigator to be most closely related to Bloom's initial and subsequent conceptualization is the format developed by Block (cf. 1971, 1973a) and, more recently, by Block and Anderson (1975). Dolan (1977-78, p. 2), himself a former student of Bloom's,concluded that Block and Anderson's explication "is one of the few learning strategies that takes the theory seriously, that is, pays attention to the affective and cognitive history of the learner and to the optimal quality of instruction."

Unlike so many systems of individualized instruction, the mastery learning strategy developed by Block and his colleagues strives to make suggestions that can be implemented realistically in the classroom. Block explained:

> We, like Sarason (1971), are convinced that no suggestions as to what *ought to be* the case in the classroom can ever be readily adopted unless they are more sensitive to the constraints of what actually *is* the case . . . . For example, we have found that teachers typically face pressure to get through a fixed curriculum in a fixed period of time; that the bulk of this curriculum is usually contained in prescribed textbooks; that most teachers already possess some successful techniques for getting through this curriculum; that most teachers' instruction is necessarily group-based and teacher-paced; and that teachers need to give grades and their students need to receive them (1977c, pp. 340-341).

Respecting the *status quo* in classrooms, Block and his colleagues have attempted to develop a mastery learning strategy that produces substantial changes in classroom practices, but that does so gradually. Block and Anderson (1975) have published their version of the mastery learning strategy in a book primarily addressed to teachers. Their format translates the mastery learning philosophy into a logical step-by-step method for creating a conducive instructional system. In this book, in most of Block's papers, and in Block's presentation to a workshop at Sharbot Lake High School in Ontario, the point has been emphasized that proponents should proceed slowly--"start small." He tries to get teachers to begin to question their assumptions about student abilities to learn, to begin to internalize the philosophy that all *can* learn and all *will* learn, to begin to test that philosophy by trying out a mastery strategy in basic skills areas, and by trying out bits and pieces of the implementation plan (cf. Block, 1977c).

As an example of the "start small" tactic in implementation, Block notes that Kim in South Korea started with teaching simple geometric figures to 272 seventh-grade students in an eight-session learning unit. His next project involved teaching maths and English to 5,800 seventh-graders over an eight-week period; next, around 26,000 seventh-graders were taught maths, English, physics, and biology under mastery strategies over an entire school year. Currently, Kim's work involves several hundred thousand students and the full range of elementary and middle school subjects. Block (1977c, p. 340) reports: "Under extraordinarily high student-teacher ratios (about 70 to 1), . . . Kim *et al.* have been slowly but surely converting the entire South Korean elementary and middle school system to mastery approaches to instruction."

The major reason that "sympathizers" have been encouraged to start with basic skills is that "students' mastery of these skills has great political appeal . . . . After all, basic skills lie at the heart of most elementary and secondary school curricula" (Block, 1977c, p. 339). Success in these areas can generate support for more widespread application.

The format for implementation developed by Block and Anderson (1975) focuses on two components: a commitment to criterion-referenced evaluation and a strong emphasis on feedback and correctives throughout the learning experience. There are four major operational steps: defining mastery, planning for mastery, teaching for mastery, and grading for mastery. Each step is now discussed. (The discussion is a summary of ideas from Block and Burns, 1977; Block and Anderson, 1975; and Block, 1977b.)

Defining Mastery. The teacher wishing to use a mastery learning approach must consider two basic pre-conditions: defining what "mastery" will mean in the particular subject, and preparing the course so that the majority of students can achieve "mastery" of the subject content. The first responsibility requires the teacher to set up instructional objectives which specify the major content areas of the course and what the student is expected to *do* with the content in each of these areas (e.g., intellectually, emotionally, or manually) and at what level or levels. In addition, the teacher prepares a final examination (summative test) directly based on the instructional objectives of the course and decides which standard of performance will indicate mastery of course objectives. This performance standard is typically that of A-level students (85 to 90 per cent) who have been taught with traditional, non-mastery methods.

To accomplish the second pre-condition--potential mastery for all students--the teacher divides the entire course into a sequence of identifiable teaching-learning units. In a similar manner to the overall course preparation, the teacher determines the instructional objectives to be covered in each of the units just outlined.

Block recommends that units cover about two weeks' worth of material. He further urges teachers to try to sequence their units in some logical way--either hierarchically (building from the less difficult to the more difficult) or linearly (where material in one unit is necessary before material in a second can be mastered). Block argues that most textbooks teach discrete topics, with no logical sequence. Linear sequences are especially appropriate for maths and physical sciences, while hierarchical sequences are appropriate for other subjects. The major objective is to sequence course material so that what is already learned can be used over and over again in later learning.

In the Sharbot Lake workshop, Block (1977b) explained the necessity of seeing a total course as a whole consisting of many parts. The parts become learning units. By dividing a course in this way, a teacher is able to identify student learning problems over the short run before it is too late or too difficult to deal with them. This is the rationale for units of no longer than two weeks' duration, and it is the rationale for *ensuring* that students have an opportunity to correct problems in learning one unit *before* moving on to the next. (The principal investigator sees this as radically different from instructional practices that include extra work for "slow" students to take home, or remedial classes after school, at the same time that the class is proceeding into the next unit. Students with homework on a new unit are most reluctant to go back to other material largely on their own.)

Block also noted that when teachers divide a course into units in the logical way described above it becomes easier for them to "weed out" what he sees as a lot of "dead weight" in the curricula across the grades. In his experience, much course content appears once, and the student never uses it again. Some (about 20 per cent) of the content comes up over and over again. As an example, Block (a former mathematics teacher) said that much of what is taught in grades 5 and 6 maths is not necessary at all in order to learn algebra. On the other hand, to be a good mathematician in real life, one does not need to be able to deal with abstractions. He asked, "When was the last time you saw a set running down a field?" Similarly, much of what we teach in English is "trivial--it's there because it's traditional. We teach by the garbage can; we teach a lot and hope some of it sticks" (Block, 1977b).

Mastery learning pre-conditions force a teacher to identify those parts of the curriculum that are necessary for *all* to master. Teachers should ask themselves, "What are the minimum things that I want *all* students to master; what is the core of this subject?" Students can learn all kinds of other things, too. Teachers, according to Block, should teach the core well and fast, and then get to enrichment materials. "Don't let the frills short-change the core, though." Enrichment materials (or optional courses) recognize individual differences in learners' interests but the mastery learning strategies should not yield differences in learning. That is, all should master whether the objectives are core or enrichment *if* the mastery instructional sequence is followed. Teachers, however, might want to use the instructional sequence *only* for core curriculum.

It should be noted here that, with respect to the development of a summative test (or final examination), Block (1977b) stressed that the reason for preparing this at the time that objectives are set for the entire course was to underline the need for the actual objectives to be reflected in the test. The same principle is true when teachers reach the stage of more specific planning for each unit (formative test construction). It is not enough to prepare a test (either formative or summative) and set a standard of mastery for it. This procedure is meaningless unless the test itself is based on the objectives. Thus, standardized achievement tests or test items taken from textbook resource guides may be inappropriate. (Indeed, standardized test items are chosen to discriminate among learners rather than to test learners on knowledge that all are expected to have gained in school.) Block also pointed out that testing does not have to be only in paper-and-pencil terms. There are several good instruments available now for testing in the affective domain; there are examples of "critical incidents" testing. Tests, in whatever form, should be as complicated as the objectives are.

In the workshop, Block asked for a show of hands to indicate whether or not the participants (primarily teachers from Frontenac County schools) had ever had a course in testing. A few hands were raised. When asked how many had experience in criterion-referenced testing, *no* hands were raised.

Block noted that teachers generally are unaware that there are three schools of testing: evaluation, measurement, and assessment. Evaluation determines the extent to which students have changed as a result of the instructional situation in the classroom. Measurement is designed to identify individual differences in students; an example would be an intelligence test with its focus on genetic differences. Assessment determines the impact of all the learning environments of a student.

Mastery learning, according to Block, uses an evaluative approach to testing that is accompanied by an individual approach to grading. That is, a competitive grading system is one in which if one student wins, another loses. A cooperative grading system is one in which if one wins, all win. An individual grading system is one in which one student's "winning" has no bearing on another's winning or losing. Students, under mastery learning, are competing against standards and not against other students.

It was clear that teachers need more information on such distinctions in testing and grading. They would be well advised to consult references such as Block (1977d); Bloom, Hastings, and Madaus (1971); Popham (1975); and Block (1973b).

Planning Mastery. The third and final pre-condition for mastery learning implementation is to design the instruction, unit by unit. The teacher first plans, for each unit, how he or she will initially present the material and involve students in its learning. Teachers are encouraged to plan on using their customary group-based teaching methods. The difference is that teachers realize that their usual method of presentation, involvement, and encouragement will *not* be an optimal instruction for all students. Thus, plans are made in advance to offer additional and alternative instruction, if it is needed.

The most critical task, in terms of learning for mastery, is the development of "feedback/correction" procedures to be used at the end of each unit's initial instruction. The teacher constructs a brief, diagnostic-progress or "formative" test over the unit's objectives and specifies a score or performance standard (typically 80 to 90 per cent correct) which will indicate unit mastery. The test should provide information on how each student's learning is changing as a result of the unit's initial instruction. (The same reference sources as given above for summative test construction would be useful here.)

The teacher, according to Block (1977b), should recognize that he or she has a gift, a talent, and that his/her teaching is based on this. However, there may be other talents the teacher does *not* have. Similarly, students may have different talents, and they respond differently to teaching styles. Essentially, Block was attempting to illustrate, as other educational psychologists have, that intelligence is not a unitary trait that you either have or do not have. He spoke of most intelligence tests as measuring a single trait--verbal ability. However, Guilford (1957) and Thurston (1938) have identified *several* primary mental abilities.

Block stated that while only 15 to 20 per cent of the population is gifted on the verbal mental ability, some 80 per cent of the population is gifted on at least one of the primary mental abilities. Most textbooks, most teaching, and most testing reward only *one* primary mental ability--verbal. If a teacher only presents material verbally, only 10 to 20 per cent of the students will master the material (the usual rate of "A" students in normal instructional conditions). Thus, teachers are encouraged to identify ways of presenting the material to be learned that will appeal to the other gifts that different students have.

For these reasons, teachers design the instruction for each unit to include a set of alternative instructional materials and procedures or "correctives," keyed to each item on the formative test. The correctives are designed to reteach the material and/or reinvolve the student in learning the material in ways that differ from the original group-based instruction. The student is *not* to be directed simply to restudy the material in the same old ways. The correctives that Block encourages teachers to try including are individual tutoring, different textbooks, workbooks, audio-visual materials, and small-group study sessions. Table 1 summarizes some of the correctives that Block and his colleagues have found to be effective. The table also indicates, for each corrective, whether it focuses primarily on representing problematic material and/or reinvolving students in learning. Block and Anderson (1975) present procedures by which teachers can construct correctives.

Block and his colleagues have found small-group study sessions to be the most versatile for students across primary, secondary, and post-secondary levels. In essence, each student is offered all the advantages of a tutorial approach to instruction, yet more than one student is receiving tutoring at one time. Individual correctives seem to work better with older students than with younger ones.

It is essential that teachers design correctives in advance of the initial group instruction because, in mastery learning strategy, correctives are a basic part of the instruction. This is why it is *not* enough to prepare formative tests and present feedback to students. The teacher's responsibility goes beyond that. As Block explained to the Sharbot Lake teachers, mastery learning proponents argue that all students *can* and *will* learn; they do not claim that all students *want* to learn. Thus, most of the responsibility is placed upon teachers to plan correctives and to include their use in classroom situations (not as work sent home or left to the option of the student). In this way, use of the strategy cuts down on procrastination, according to Block. "All students start at the same time and aren't allowed to wait until the tenth week to start learning." Since mastery strategies (including use of correctives *before* proceeding to the next unit) are designed primarily for use on the important core of a course that *all* students should master, the extra time spent should pay dividends in later learning. Block and Anderson (1975) have found that students soon learn which type of corrective works best for them, and their later learning becomes much more efficient.

Teachers are encouraged to recognize that the existence of student learning problems does not mean that they are poor teachers. However, it also does not mean that students are poor learners. The teachers' normal (and best) method of presentation may be ideal for *some* students.

TABLE 1

A SUMMARY OF GENERAL TYPES OF CORRECTIVES

(Adapted from Block and Anderson, 1975, p. 38)

CORRECTIVE	INDIVIDUAL	GROUP	RE-PRESENTATION	RE-INVOLVEMENT
Alternative Textbooks	X		X	
Workbooks	X		X	
Flashcards	X		X	
Re-teaching		X	X	
Audio-Visual* Materials		X	X	
Token Economies	X			X
Academic Games		X		X
Group* Affective Exercises		X		X
Programmed Instruction	X		X	X
Tutoring	X		X	X
Small Group Study Sessions		X	X	X

* These correctives might also be used on an individual basis in some situations.

Others may learn more effectively when the material is presented by other students, either same-age or cross-age, by mothers, by retired persons, or even by other teachers. Any one of these groups may have ways of presenting material that is very different from that of the teacher concerned, and this is especially the case with students' presentations to other students. While alternative instructional aids such as workbooks or other textbooks are suggested, Block (1977b) personally stresses the use of human resources rather than "gadgetry." Nevertheless, some students learn well from programmed instruction; others do well with academic games and puzzles; and some react well to affective techniques (e.g., having a student tell another what it feels like to be a + sign).

The major premise is that if a student is not learning, the teacher does not send him/her back to the teacher for more of the same. If the majority of a class does not master a unit, teachers are encouraged to cooperate with each other, to trade classes and to try whole-group representation with each other's classes. Thus, both teachers and students cooperate in the mastery system.

Teaching for Mastery. Having defined mastery (identified course objectives), having concretized mastery (constructed a summative test and set mastery standards), and having designed instruction (established learning units, sequenced units, and developed plans for original instruction, constructed formative test, and planned correctives), the teacher is now ready to teach. It should be clear, then, that the mastery learning strategy demands that a great deal of activity go on *outside* the classroom in teacher planning, so that a more effective job can be done *inside* the classroom. It is very time-consuming to design a single two-week instructional unit. For this reason, Block and his colleagues have *not* encouraged teachers to construct diagnostic tests for use prior to the initial instruction. Further, Block (in Brandt, 1976) believes that teachers need help in implementing the steps to be taken before actual instruction begins, and he offers some suggestions for receiving such help. (See Chapter 5 for a discussion of how the Chicago Mastery Learning Reading Program facilitates the implementation of the "pre-conditions.")

When instruction on a unit is ready to begin, the teacher must first orient the students who are not accustomed to learning for mastery by introducing the notion that all students can now conceivably receive A-level grades. This orientation attempts to provide students, in advance, with the information about what they are expected to learn in the course, how they are generally expected to learn, and to what level they are expected to learn.

The course gets underway, then, with the teacher's initial instruction on the first unit of subject content. Instruction completed, the diagnostic-progress test is administered and the test results are interpreted to identify those students who have achieved the unit mastery standard and those who have not. The former students are free to engage in enrichment activities and/or act as tutors for their classmates, while the latter group are encouraged to use the variety of correctives to complete their learning of the unit subject content. The teacher decides when initial instruction will begin on the subsequent unit, and students are expected to make appropriate use of the opportunities provided during the intervening time. The teacher is encouraged to provide in-class time for these.

The teacher repeats this cycle of responsibilities (initial instruction, diagnostic-progress testing, identification of mastery and non-mastery students, and correction procedures) unit by unit, until the material in each section has been successfully covered by the majority of students. The units are paced so that a similar amount of material can be covered using a mastery learning approach as would be possible, given traditional methods and the calendar time available for instruction.

Block and Burns (1977) suggest two pacing options for the teacher in covering the course content. Unit instruction may be paced according to a more traditional rate of progression if all or some of the correction responsibilities are to be handled outside of class. Or, in preference for the greater effectiveness of corrective procedures used in class, the teacher can adjust the pace of instruction to allow more review time in the beginning units. Typically, about 10 per cent additional time is needed for the corrective process. It is believed that a basic foundation of mastered material can strengthen the students' subsequent understanding and, in effect, speed up the amount of time necessary for mastery on units in the latter half of the course.

Recall that Block believes it is important to reduce the "fat" in the core curriculum that is taught for mastery, and that enrichment learning may proceed while corrective procedures are being followed by other students. If mastery learning strategies enjoyed widespread implementation, Block (1977b) argued that the time could come when the elementary years' core curricula could be mastered in four years, leaving four years to do the enrichment or creative kinds of things that used to be reserved for the so-called "bright" students.

Grading for Mastery. The final examination, which was prepared in the initial phases of planning, is used at the end of the course as a summative evaluation of each student's ability to master the course content in accordance with the mastery performance standard determined during course preparation. Those students whose test results are above the course mastery performance level are awarded A grades, while the students scoring below this level are awarded grades appropriate to the level they have achieved.

Most mastery learning proponents argue that, in the ideal form of implementation, students would receive either an A (80 to 95 per cent) or an incomplete. However, Block recognizes that teachers usually must give all students some grade or mark. He simply encourages teachers to determine in advance the performance standards which are to be indicative of B, C, D, or F work. The intention of mastery learning evaluation systems is to place each student in competition with a recognized performance standard rather than in competition with classmates.

If mastery (A level or 80 to 95 per cent) levels are predetermined, there would be no such thing as a limited number of these marks available. The student is rewarded for mastering to that level, regardless of how many or how few others also have attained that level. If a teacher's course objectives and mastery performance standard are defensible on educational grounds, then the teacher should be able to withstand any criticism of it, if in fact 80 to 85 per cent of the class receives an A grade.

This section has described the practical form of implementation developed by Block and his associates from Bloom's original operationalization of Carroll's model of school learning. During the past decade, sizeable numbers of research studies have been conducted to test the effectiveness of mastery learning strategies; some of these are reviewed in Chapter 3. It must be noted, however, that research reports do not always provide enough information about the pre-conditions and the actual instructional design to enable reviewers to distinguish between the version being tested and the format suggested in this section. We assume that the basic elements are at least present in each situation.

As these research results and others, including Bloom's own work, were analyzed, Bloom recognized that patterns were emerging that seemed to refute many of the accepted assumptions about human characteristics and school learning. The result of his questionings, analyses of available empirical data, and conceptualizations was a new theory, to which we now turn.

Bloom's New Theory of Human Characteristics and School Learning

The central theme of Bloom's book (1976) has grown from work on mastery learning. Research on mastery learning, according to Bloom (1977a), has been done in many countries and at all levels of education. Many of the different subject courses at each level have been shown to yield excellent results under mastery methods. It has become evident that a large proportion of slower learners can learn to the same achievement level as faster learners, that they appear able to learn equally complex and abstract ideas, that they can apply these ideas to new problems, and that they can retain the ideas equally well. Thus the achievement of mastery-taught students is not predictable from aptitude tests prior to instruction. Reviewing studies using a comparison between mastery students and "control" groups (students taught by the same teacher using the same initial instruction but no feedback and correctives), Bloom concluded:

> It is not hard to understand why the mastery students should do so well on the final achievement measures. They were given feedback on what they had learned and what they still needed to learn . . . . This was followed by individualized help until they attained mastery of the learning unit. This was repeated on each successive unit until most students in the mastery group no longer needed this crutch. Each student entered each succeeding period of instruction with a good grasp of the prerequisites to that unit as well as with increased assurance that he had learned well and could learn

> the next unit to a high level. The mastery students become more and more similar in their achievement and that achievement is at a high level (Bloom, 1977a, p. 7-8).

In analyzing why "control" students differ so much in their final achievement, Bloom argued that one of the most important elements in accounting for individual differences in school learning is the centrality of group instruction in schools throughout the world, a procedure that is effective for some learners and ineffective for others. This system of group instruction produces errors in learning at each stage of a course, which are compounded with later errors. The errors in the instructional system limit the learning of each student, and only rarely is an individual able to fully recover from them. One of Bloom's major theses, then, is that a system of feedback to teachers and students can reveal the errors in learning shortly after they occur. He believes the essence of mastery learning strategies is to introduce appropriate correctives as they are needed so that the educational system can be a self-correcting system, with errors corrected before they are compounded with later errors.

The research of Bloom and his students has led him to an important construct: *Most students become very similar with regard to learning ability, rate of learning, and motivation for further learning when provided with favorable learning conditions.* This questions the earlier constructs that there are good learners and poor learners (i.e., aptitude is stable and predicts school performance) and that there are fast learners and slow learners (i.e., that aptitude is an index of the time a student needs to learn). Bloom's construct especially questions the permanence of such traits, and it argues that learning characteristics such as good-poor and fast-slow are alterable by appropriate school conditions. Under unfavorable learning conditions, students become more dissimilar in learning ability, rate of learning, and motivation for further learning. Schools today, Bloom argues, provide unfavorable learning conditions and thus widen the gap between high and low achievers at each successive grade level.

To develop his theory, Bloom marshalled available evidence on the critical causal variables of student outcomes and developed a causal framework of both student and instructional characteristics. Bloom's theory is comprised of three major independent variables that, if properly attended to, should enable schools to become error-free. The first of these, *cognitive entry behaviors*, represents the student's history of previous development and learning. Bloom argues that the school curriculum assumes prerequisite knowledge and skills before new learning tasks are undertaken. If there is great variation in the prerequisite learning, then there is likely to be great variation in the outcome of the new instruction. As Harvey and Horton (1977) note, if Bloom is right about the significance of cognitive entry behaviors, "then students are presently graded and evaluated not on what they learn in a particular course or term, but on the relevant cognitive entry skills they possessed prior to the beginning of the course." Bloom believes that cognitive entry behaviors can account for as much as one-half of the variance on relevant cognitive achievement measures over subsequent learning tasks.

The second independent variable is *affective entry characteristics*, or the extent to which the student is or can be motivated to engage in the learning process. In his book (1976) and in another paper (1977b), Bloom demonstrates a significant relationship between affective characteristics and related measures of school achievement. The affective characteristics are complex and include interests, attitudes, and self-concepts. Students who enter a new learning task with a history of positive affective characteristics will learn more rapidly and at higher levels of achievement than will those who lack enthusiasm and interest. Bloom argues that affective learning characteristics can account for one-fourth of the variance on relevant cognitive achievement measures on subsequent learning tasks.

The third variable is an instructional characteristic, which Bloom labels *quality of instruction*. Although it is doubtful that the quality of instruction can overcome the effect of negative cognitive entry behaviors, Bloom argues that the learning task can be altered to be developmentally appropriate to the student's background. In contrast, he believes that the quality of instruction can have a potent effect on overcoming negative affective entry behaviors. Bloom reasons that much research on instruction has been related to ways by which the teacher manages learners (e.g., classroom organization). He uses the model of a tutor attempting to teach something to a single student as an example of a teacher managing learning. The definition of "high" quality of instruction, then, includes the provision of cues as to what the student is to learn, involvement of the student in the learning process, giving reinforcement to the student, and the provision of feedback and correctives. In essence, then, Bloom is proposing a mastery learning strategy as a means of improving the quality of education, which can account for at least one-fourth of the variance on relevant cognitive achievement measures.

Because Bloom's theory implies that individual differences in learning outcomes can be altered or eliminated, Dolan (1977-78, p. 1) has called it "one of the most optimistic views of the power of the school." Nevertheless, the tremendous power attributed by Bloom to the developmental history of the learner implies strongly that mastery learning strategies should be used in the early elementary grades especially. Bloom presents evidence from studies comparing mastery students with control students, and some of the major findings lend weight to his theory and its implications. Among these findings are the following:

(1) Under favorable learning conditions (mastery learning), the level of learning of students tends to rise over a series of learning tasks so that, on the last learning task, as high as 80% attain the criterion score without corrective help. In contrast, control group performance drops slightly from task to task, with as few as 10% attaining the criterion on the final task. These phenomena occur despite the fact that, on the first task, only around 20% of both the mastery and the control groups attain the criterion.

(2) Students who have learned the first course in a subject to a high level tend to learn subsequent courses in the same subject to a high level with less and less in the way of extra time and help.

(3) While variation in the rate of learning for students at the beginning of a series of tasks is approximately 5 to 1, mastery students who are given feedback and correctives appear to become more and more similar in their learning rates over the series, until the variation is as low as 1½ to 1.

(4) Studies of degree of involvement or participation in group learning find similar degrees in mastery and control groups on the first task. Over the series of tasks, the mastery group tends to become more and more involved and the control group less and less involved (see Bloom 1977a).

Bloom's theory has far-reaching implications for the training of teachers, instruction in the classroom, the organization of systems of education, grading procedures, and the development of new curriculum and instructional systems. Bloom (1977a, p. 14) concludes: "The main import of the entire book is that human nature is not the barrier to educational and cultural development that philosophers, politicians, social scientists, and educators have frequently alleged."

3 Overview of Mastery Learning Research

During the ten years between Bloom's initial efforts to transform Carroll's (1963) model of school learning into an instructional system and his development of the revolutionary theory of the alterability of human characteristics, versions of the instructional system (mastery learning) were being tested. At first, the researches were small experimental studies on highly sequential subject matters. Recently, the early experimental work has been supplemented by applications to more typical school environments. Dolan (1977-78, p. 2) concluded, "Now there exists an ample body of evidence of its success for a variety of school levels and curricular emphases."

There are two major reasons for the small, experimental nature of most mastery learning research to date. First, Bloom and his students deliberately and appropriately started on this scale because of the nature of their efforts--they were primarily interested in testing and refining the theory, rather than testing its applicability *before* a firm conceptual basis was laid. Secondly, those associates who were more interested in the application of the theoretical principles in schools and classrooms recognized that valid implementation required enormous changes in the teacher's role and in curricula. Thus, many of them worked with teachers who voluntarily agreed to try out the system in a small way. Others worked on materials that might assist teachers in implementation. Recall that Block encourages teachers to "start small." These strategies for implementation are in direct contrast to many other curricular and instructional innovations of the same era that promised immediate solutions to educational ills.

Mastery learning as an instructional strategy thus has developed from a base of cumulative research. Unfortunately, we have found that many teachers, administrators, and school trustees believe that research must be large scale in order for its findings to be accepted (cf. Ryan and Greenfield, 1975). For a strategy like mastery learning to be tested on a massive scale in a single research effort, the researchers would either have to be satisfied with *assuming* implementation and collecting only pre- and post-achievement measures (which, to be at all applicable, would have to reflect only common objectives identified by large numbers of teachers), or the research design would be inordinately expensive. Mastery learning is a strategy to be implemented in classrooms; thus, it is vital for researchers to have access to classrooms. As a researcher, the principal investigator would place much more faith in a small, carefully done study that took the investigator into the classroom than a massive study in which the investigator sought only to collect achievement (or outcome) data.

In preparing this chapter, we sought to include only experimental studies at the elementary and secondary school levels. We were fairly limited to studies that were published or to reviews of published and unpublished work. We found that much of the mastery learning research was unpublished, in the form of doctoral theses or papers presented to colleagues at the American Educational Research Association's annual meetings. Further, many efforts at implementation by schools or individual teachers do not get into the research literature. In many cases, practicing educators may have taken a course from a professor who has become acquainted with mastery strategies. In their implementation efforts, such practitioners often do not have the resources or the motivation to establish "control" groups of students or to conduct comparative studies. Their purpose is to test the system's effectiveness for themselves. For this reason, we have supplemented the review of published research in this chapter with survey reports that we collected from practicing educators who had some implementation experience (see Chapter 4).

The summary of research presented here relied heavily, but not exclusively, on the studies reviewed by Block and Burns (1977). The studies included in their review met two general criteria: a substantial degree of external validity (performed in an actual school setting and employing subject-matter-centered, relatively complex, and time-consuming learning tasks) and a high degree of internal validity (at least quasi-experimental research designs with roughly equivalent groups of students at the outset). The studies they included, then, represent what they believe to be the best of the mastery learning research to date.

From these studies, we selected only those at elementary and secondary school levels and only those that reportedly tested a group-based, teacher-paced form of mastery learning. In a few cases, we had to rely on abstracts of study reports or on the review by Block and Burns because the study reports were inaccessible (and in the case of Kim *et al.*, not translated into English). The studies included in our review are listed in Table 2. For more detailed information, see Tables A1. and A2. in Appendix A.

Cognitive Outcomes of Mastery Learning--"Does It Work?"

We looked first at studies that examined the effect of the mastery learning approach on cognitive achievement, including retention, transfer of learning, and variability of achievement within a class. This type of research has been categorized by Block and Burns (1977) as Type I research that is addressed to the assumption that virtually all students can learn well under favorable instructional conditions. Specifically, they ask the questions, "Do mastery approaches to instruction allow more students to learn better than has traditionally been the case?" and "Do mastery approaches reduce the variability in student achievement?"

The results from 15 studies that were of this type reveal that the answer to both questions is affirmative. In 12 of the 15 studies, mastery-taught students did significantly better than the control students on locally devised tests of achievement. In one of these studies, students also were given a standardized achievement test, and the results were mixed (see discussion below). In two of the other three studies, mastery students did better than the controls, although the results were not significant.

Only nine of the 15 studies examined the variability within mastery and non-mastery groups on their achievement. In eight of the nine studies,

51

TABLE 2

STUDIES REPORTED IN THE PRESENT REVIEW

	Grade	No. of Studies	Author	Outcomes Measured	Subject
Grades 1-6	1-6	1	Anderson (1976a)	Achievement, attitude	Mathematics
	Primary	1	Okey (1975)	Achievement	Mathematics, Language arts
	2	1	Kim et al. (1974)	Achievement	Moral education, Korean, Mathematics
	3-4	1	Okey (1974)	Achievement, attitude	Mathematics
	4-5	1	Burrows, Okey (1975)	Achievement	Mathematics
	5	1	Kersh (1970)	Achievement	Mathematics
	5-6	1	Lee et al. (1971)	Achievement	Mathematics Science
Grades 7-12	7	3	Kim et al. (1969)	Achievement	Mathematics
			Kim et al. (1970)	Achievement	Mathematics
			Jones (1974)	Achievement	Social Studies
	8	5	Fiel, Okey (1975)	Achievement	Science
			Block (1972)	Achievement, attitude	Mathematics
			Anderson (1976b)	Learning time in ML, attitude	Mathematics
			Collins (1970	Type of correctives used in ML	Mathematics
			Block (1973b)	Achievement, attitude	Mathematics
	HS	2	Hymel, Gaines (1977)	Achievement	Mathematics
			Wentling (1973)	Achievement, attitude	Auto Mechanics

variability in the mastery-taught groups was significantly less than in control groups (i.e., more students scored similarly). Only five studies investigated student retention of learning some time after the initial testing; in each of these studies, mastery-taught students scored significantly better than control students. Finally, of the three studies that examined transfer of learning (in subsequent courses), each found significant results favoring the mastery-taught students. We now examine the studies in more detail. They have been grouped by grade levels, 1-6 and 7-12.

Grades 1-6. Seven studies compared grade 1-6 students in mastery and non-mastery classes in terms of achievement of common learning tasks. Kersh (1970) selected 12 mastery-taught grade five mathematics classes, six from a socio-economically disadvantaged population and six from an advantaged population. She compared these classes with non-mastery classes taught by the same teachers the previous year. In the advantaged group, 75 per cent reached the mastery level as compared with only 19 per cent in the control group (the previous year's students). In the disadvantaged group, the figures were 20 per cent and 0 per cent. The differences in both comparisons were statistically significant.

Burrows and Okey (1975) compared a group of three classes using mastery learning in grades 4 and 5 mathematics with a control group. The mastery group did significantly better on a test of achievement as well as on a test given two weeks later to measure retention. Furthermore, there was significantly less variability in the mastery group on both achievement and retention. This implies that "poorer" students in the mastery group were performing much more like the "good" students.

Okey (1974) found that out of four mastery-taught mathematics classes in grades 3 and 4, only one achieved significantly better than the control group, but the other three also achieved better (though not significantly so). One year later he issued a report (Okey, 1975) of primary classrooms and their experiences with mathematics units and language arts units using the mastery approach. Out of 14 comparisons, half significantly favored the mastery groups in terms of achievement, and the other half favored mastery groups (though not significantly). Nine comparisons showed reduced variability.

53

Anderson (1976a) focussed on mathematics classes at each grade level from grade 1 through grade 6, each level being represented by six classrooms. When tested with *locally* constructed instruments, the mastery students were clearly superior in achievement, reduced variability and, to a lesser extent, retention. The results of three standardized tests, however, provided a somewhat different picture. The mastery students were favored significantly in 17 out of 18 comparisons of variability, but were significantly better in only three of 18 comparisons of achievement. Nevertheless, the mastery students were at least better (though not significantly so) in another eight of the 18 comparisons. Thus, in 11 of 18 comparisons, mastery groups tended to score somewhat better, and their scores showed less variability within the group.

Although one would have thought that the mastery and control groups differed only in terms of teaching method and not in terms of basic curriculum, a personal communication from Anderson to Block (reported in Block and Burns, 1977) explained that the mathematics curriculum taught for mastery tended to place little emphasis on problem solving or concept learning. Not surprisingly, then, the mastery students performed well on the standardized tests in computation, but they did not always perform better on the tests in problem solving or in concepts. This discrepancy is an important one in terms of the objectives that a teacher specifies and toward which the teacher moves in the instructional, feedback, and correctives processes. Block (1977d, p. 34) spoke to this issue:

> One of the first problems we have encountered with our evaluation system is that it sometimes orients some students too well. As the course taught for mastery unfolds, these students tend to ignore any material that they perceive to be incidental to the core of their teacher's instruction. Hence, their learning of this incidental material can be low.

Two other studies (Kim *et al.*, 1974; Lee *et al.*, 1971) are remarkable in that the experiments involved over 1,400 South Korean students in the first instance and over 12,000 in the second. It is also interesting to note that in South Korea the average pupil-teacher ratio is approximately 70:1. In Kim's study, 906 grade 2 students experienced the mastery approach in mathematics and, at the end of eight months summative tests revealed that their achievement was significantly greater than that of the non-mastery group, although variability was not significantly reduced. Lee evaluated the effects of mastery learning on students in grades 5 and 6 mathematics and science classes. The results favored the mastery students in all four comparisons of achievement and in three out of four comparisons of variability.

Grades 7-12. Two previous studies by Kim and his associates (1969, 1970), reported the effects of mastery learning on grade 7 students. The earlier study involved 272 students, half of whom learned mathematics under the mastery approach. Summative tests indicated that 74 per cent of the mastery group were able to reach the criterion as opposed to only 40 per cent of the non-mastery group. One year later, Kim reported somewhat similar findings from nine middle schools using the mastery approach in half of their grade 7 mathematics and English (foreign language) classes. From a total of 5,800 students, 61 per cent of those reaching criterion in mathematics were mastery students and 72 per cent of those reaching criterion in English were of this group.

Kim reports that there were notable differences in the results from the nine schools. This he attributes to (a) variation in the schools' learning climates, (b) variation in the schools' and teachers' cooperation, (c) inefficient utilization and administration of the instructional materials, and (d) the failure of some teachers to follow the experimental operating procedures. The same kind of problems seem to accompany the implementation on a large scale of almost any educational innovation, a condition which makes evaluation of the innovation a difficult task.

One other experiment at the grade 7 level was conducted by Jones (1974) using 20 social studies classes, approximately half of which utilized the mastery approach for a period of four weeks. At the end of that time, the summative test results showed no significant difference between mastery and non-mastery groups in achievement, but variability in the mastery group was significantly less than in the control group. This means that the "poorer" students at least tended to score more like "better" students.

Three experiments were reported which utilized classes at the grade 8 level (Fiel and Okey, 1975; Block, 1972; Block, 1973b), the first involving science and the other two, mathematics. In each case, substantial support was given for mastery learning as the result of measures of achievement, retention, transfer, and variability.

Finally, evidence from two further scources significantly favors the mastery learning approach at the high school level. Hymel and Gaines (1977) found that mastery mathematics students outperformed the control group, while Wentling (1973) reported on the superior achievement and retention of mastery students in auto mechanics classes.

Affective and Time Outcomes--"If it works, what follows?"

Affective. Most of the studies that have examined the affective consequences of mastery learning implementation have been conducted at the post-secondary level. Only five studies were reviewed at the elementary or secondary level from this perspective. The studies variously investigated student attitudes toward subject matter instruction, attitudes toward teaching method, academic self-concepts, and cooperative attitudes. In each case, except the latter, the researchers used standardized tests. The results tend to support mastery strategies in that more favorable affective responses came generally from mastery-taught students than from control students, and, in some cases, the differences were significant. One study examined teacher attitudes after a self-instructional module in teaching for mastery learning, and the results showed significant differences in pre- and post-training measures. Each study is now described in more detail.

Of three studies comparing the attitudes toward the subject matter of mastery and control groups, seven of 15 comparisons significantly favored the mastery groups, while another six were favorable (but not significantly so). Thus, in 13 of the 15 comparisons, the attitudes of mastery students toward the subject matter being taught was at least somewhat better than those of control students.

Block (1973b) measured students' interest in and attitude toward mathematics, and found no instance of significantly better attitudes for the mastery group, but in all three comparisons, the mastery group attitudes were at least more favorable. A year earlier, Block found two of three similar comparisons in another study to favor significantly the mastery groups, and the other comparison favored a mastery group to a lesser extent. It should be noted that these experiments took place over periods of only one week and five weeks, which may be too short to measure reliable effects on attitudes. Although only five of nine comparisons in Anderson's (1976a) findings favor the mastery approach to a statistically significant degree, three of the four remaining comparisons tend toward significance. These measures, moreover, were taken after nine months of mastery learning implementation in mathematics.

Only one study, Wentling (1973), investigated the attitude of students toward teaching methods. In automobile mechanics courses, he found no significant difference but the mastery group did tend to have somewhat more positive attitudes than did the control group. His test was administered over a period of five weeks.

Anderson (1976a) also administered a standardized test that allowed comparisons of academic self-concept between mastery-taught and control groups of students. Of three comparisons, one significantly favored the mastery classes and the other two favored mastery classes to a lesser extent. Lee *et al.* (1971) used a locally devised test to examine students' cooperative attitudes. Both of his comparisons significantly favored the mastery approach.

The only indication of teacher attitudes comes from a study by Okey (1974). Twenty-one teachers, whose teaching experience ranged from 0 to 20 years, were enrolled in a graduate science methods class. Tests were given before and after their exposure to a four-hour, multimedia, self-instructional module called *Teaching for Mastery*. (The module itself used the mastery learning techniques.) Following the treatment, there was a significant improvement in the teachers' attitudes toward tests, grades, and diagnostic teaching. The experiment was too small and too brief to justify generalizing the results, but it does suggest a means of gaining teachers' cooperation when a school takes steps to implement mastery learning.

Time Consequences. Questions that are frequently asked about mastery learning implementation are: "Do mastery strategies hold back 'faster' learners while 'slower' ones catch up?" and "If not, where does the teacher find the extra class time to teach 'slower' students for mastery?" Few research studies have addressed these questions directly, but Block and Burns (1977) identified several that were at least indirectly related.

Of seven studies examining the amount of student study time required for mastery, the results clearly indicate that mastery strategies require much greater student study time than usual, over the short term at least. A few examples indicated that the additional time requirement *might* become more reasonable over the long term, as slower students begin to learn more like faster students do, but this finding needs much additional research. The greater study time required for mastery learning is evidence of Block's (1977b) hypothesis that mastery learning strategies reduce student procrastination. Given the cognitive outcomes evidence, it is apparent that mastery strategies require more student study time, but that time pays dividends in learning.

Among the three studies examining student study time through direct observation and self-reports, Arlin (1974) found that on the first unit of an eight-unit imaginary science course, the ratio of study time of slow learners to that of fast learners was 7:1. But by the end of the sequence, the ratio had dropped to 4:1. Likewise, Block (1972, 1973b) and Anderson (1976b) calculated a reduction from 3.4:1 to 2.1:1 over a three-unit sequence. Thus the slower learners were beginning to become more like the faster ones in study time as they were exposed to more mastery-taught units.

Six studies explored the total student study time costs of learning for mastery as compared to non-mastery learning. Block (1972; 1973b) found that the study costs were from 70 to 80 per cent higher when the mastery instruction lasted around two weeks. However, the time costs were found to be lower in four other studies in which the mastery instruction continued over periods of from a month to a full term. These studies and the greater proportion of study time for mastery learners are as follows:

Jones (1974) -- 20% more over four to five weeks
Wentling (1973) -- 50% more over four to five weeks
Hymel (1974) -- 56% more over ten weeks
Anderson (1976b) -- 10% more to 25% less over full term

Whether Anderson's optimistic findings, that slow learners begin to learn more efficiently over the course of a term, are reliable remains to be seen in future research.

Research has not been directed toward comparing various approaches that teachers might use to find extra class time to help slower students learn for mastery. However, Block and Anderson (1975) have attempted to provide practical advice to teachers. Their major emphasis has been to encourage teachers to prepare and organize outside of class, rather than in class. Block and Burns (1977) report one study, that of Greene and Bridges (1975), which suggests that this procedure allows more time for teachers to interact with students than might ordinarily be the case.

Differential Effects: "Why do mastery approaches work?"

A group of researchers, satisfied that mastery learning approaches do work, have turned their attention to variables that might modify successful or unsuccessful application of mastery ideas. Block and Burns (1977) label these Type III studies. This work is really a combination of research and development, since the research findings are intended to be used to develop more effective implementation processes. Two questions tend to be addressed: "Do mastery strategies have the same effects on different kinds of students?" and "Do some components of mastery strategies have greater effects on students than other components?"

Student Entry Differences. Four of the studies that we reviewed (Anderson, 1973; Burrows and Okey, 1975; Fiel and Okey, 1974; and Hymel, 1974) investigated four kinds of student individual differences that might affect the applicability of mastery learning approaches. These were subject-matter-relevant cognitive and affective entry characteristics (defined by Bloom, 1976, as the prior learnings and feelings about a *subject* that each student brings to the instruction) and method-relevant cognitive and affective entry characteristics (defined by Block and Anderson, 1975, as the prior learnings and feelings about the *manner* in which the student will be taught). Findings from the studies indicated that the student's entry characteristics do affect his/her learning under mastery strategies, but that the use of mastery strategies helps to *minimize* these effects. This was especially the case for cognitive differences--those students who were formerly "weak" in subject-matter-relevant and/or method-relevant cognitive entry characteristics have tended to learn more like their "stronger" peers under mastery instruction.

Examining the effects of the student's intelligence (as measured by I.Q. tests), one study provided some evidence to suggest that mastery strategies do minimize the effect of this individual difference on subsequent achievement. Kim (1969) found that in his total sample of students, 74 per cent of those in the mastery group were able to reach the criterion level while only 40 per cent in the non-mastery group succeeded. That is, 1.5 times as many mastery as non-mastery students were successful. When he looked at the achievement of above average students, he found the figures were, respectively, 95 per cent and 64 per cent--a growth rate of 1.85. With below average students, the figures were 50 per cent and 8 per cent, representing a growth rate of 6.25. We see that the growth rate of high I.Q. students is quite similar to that of the total sample (the majority of whom are of normal I.Q.), indicating that their intellectual advantage had little effect on achievement under the mastery learning approach. On the other hand, the growth rate of the low I.Q. students is more than four times greater than the total sample, indicating that their intellectual disadvantage had little effect on achievement under the mastery learning approach.

Another means of exploring the question is to look at the statistical relationship, or correlation, between intelligence and achievement. General intelligence tests typically correlate about +.50 (± .10) with achievement over a great variety of courses and subjects (Lavin, 1965). Hymel and Gaines (1977) reported that in their non-mastery group, the correlation between I.Q. and achievement was .48, quite in line with what one would expect. The same correlation in the mastery group, however, was only .29, which indicates that their achievement was less dependent upon their intelligence.

Mastery Strategy Components. Block and Burns (1977) review a great many studies that have examined the impact on student learning of the various components of a mastery learning strategy. From the results of around thirty studies (at all levels of education), they drew the following conclusions:

> . . . it has been the *unit mastery requirement* that has consistently produced the strongest effects. The failure to impose a unit mastery requirement or to ensure that the requirement has been met has tended to produce less achievement and retention and less consistent

> study behavior than the imposition of a requirement and the meeting of that requirement. Further, the imposition and meeting of different unit mastery requirements have had different student effects. The more stringent the requirement and its enforcement, the better and more similarly have students studied and learned. The less stringent the requirement and/or its enforcement, the poorer and less similarly have they studied and learned (Block and Burns, 1977, p 35).

They hypothesized that the reason for the tremendous influence of the pre-established unit mastery requirement on student learning is that this requirement has affected both the quality and the quantity of student study time. In another paper, Block and Burns (1975) had argued that the quality of student study time, and not the quantity alone, affects achievement. As noted earlier, under mastery strategies, students spend a greater amount of time in study and a greater proportion of that study time in active learning (a quality indicator).

Lest teachers infer from this important finding (and its hypothesized explanation) that mastery criterion levels should be set at 100, Block's own studies lend a note of caution. In his 1972 study, the choice of the 95 per cent level produced the greatest cognitive achievement but had negative effects on student interest and attitudes. Choice of the 85 per cent level produced the greatest interest and attitudes, but slightly less than optimal cognitive learning. Block has since come to recommend a compromise between the two levels. "A unit mastery requirement of a 90 per cent correct score on at least one of the unit diagnostic-progress tests has proven optimal" (Block and Burns, 1977, p. 35).

Two studies have attempted to identify the impact of a variety of possible "correctives" on student learning. Field and Okey (1975) divided their sample of students into three groups. Group 1 received, as a corrective, additional instruction on objectives prerequisite to those in the main-line instruction. Group 2 received additional practice items similar to those in the main-line instruction. Group 3 was the control group and received no additional instruction. Results indicated that additional instruction (Group 1) led to significantly greater achievement than did additional practice (Group 2).

Further evidence exists that mere practice may not be the best choice of corrective. Collins (1970) divided his sample of students into six groups, five of whom received different corrective treatment. The sixth served as a control group. The various treatments and their results are given in Table 3.

TABLE 3

EFFECT OF CORRECTIVE TREATMENT ON STUDENT MASTERY

(Adapted from Collins, 1970)

Group	*Correctives*	*Percentage of group reaching mastery*
1	Lists of objectives only.	60
2	Objectives plus a problem testing the objectives of the previous lesson. Discussion of the problem. Specific prescriptions for using text, class notes, and handouts.	80
3	Objectives, diagnostic problems, review prescriptions. Alternative resources (texts, workbooks, games, SRA kits).	80
4	Problems, review prescriptions.	70
5	Problems only.	50

The treatment consisting of only problems was the least successful of the five. Since the working of problems is a form of practice, it would seem that the findings of Collins and Fiel and Okey are in agreement. Treatments 2 and 3, both of which included giving objectives, problems, and review prescriptions, worked best.

A third study explored the use of specific kinds of feedback within a mastery learning experiment. Wentling (1973) used, as his sample, three classes of mastery-taught students and three non-mastery classes. One mastery and one non-mastery class received no specific item feedback on unit tests. That is, they were told whether or not they had reached the criterion level, but they did not know which items they had answered correctly and incorrectly. A second pair of mastery-non-mastery classes received partial item feedback. They were told whether or not they had reached the criterion level and which items were correct and incorrect, but they were not informed of the correct responses to items they had missed. The third pair of classes were given total feedback. If an item was responded to incorrectly, students were requested to respond a second, third or fourth time until the correct response was discovered.

In terms of achievement, the partial feedback treatment exceeded the other two treatments, but the difference was not quite statistically significant. On the measure of attitude toward instruction, the positive effects of partial feedback were highly significant. The treatment resulting in least achievement was the one employing total feedback. The author could not explain this result. On a measure of retention, none of the three treatments had a significant effect. Since we have no information about the correctives used in conjunction with the feedback, it is difficult to draw any conclusions from this study. One would hypothesize that feedback alone, in any form, would not motivate students to further study, in and of itself.

Dissemination and Implementation: "How does it work?"

Block and Burns (1977) include a fourth type of mastery learning research and development work--the production of materials to aid both dissemination of mastery learning strategies and implementation of the strategies by teachers. The most useful "how-to-do-it" book that we have reviewed is that by Block and Anderson (1975) that gives very practical advice for elementary teachers. Two general textbooks in educational psychology (Biehler, 1974, and Galloway, 1976) include sections that instruct prospective teachers in how to teach for mastery. Finally, Okey and Ciesla (1975) have developed a self-instructional module for teachers at elementary and junior high school levels. The module has been evaluated (Okey, 1975) and has been found to improve the attitudes of teachers toward several important aspects of teaching (see discussion above).

Limitations of Mastery Learning Research

We would be remiss if we did not point out certain limitations of the research studies we have reviewed. Experimental and quasi-experimental research is useful in determining whether a theory can hold up when put to the test in actual classroom conditions. Research into mastery learning is no exception, and has indeed cast much light on the subject. Unfortunately, it has also cast a few shadows. The studies we have considered in this review supply answers or partial answers to many questions, but they also raise others.

One of the limitations of most mastery learning experiments is that the duration of treatment and observation is quite short. Approximately one-third of the studies lasted less than two weeks, and in this short period of time several covered as many as three units. Block (1977d) suggests that one unit should take from 10 to 14 days, partly at least so that students are not adversely affected by too much testing. Another one-third of the studies lasted from two to four weeks; of the remaining one-third, only two covered the entire school year.

Directly related to the issue of short duration are two other problems. Teachers and administrators contemplating the adoption of mastery learning strategies need to know if the curriculum can be adequately covered in the same amount of time as by traditional methods. Research tells us that the ratio of slow to fast learners is reduced over the duration of a few units, but it does not tell us to what extent further reduction is possible over an entire course. It is probably necessary, as Block (1977b) suggests, for teachers to reduce curricular content in order to provide adequate class time for students to master the core (or most important) content. This would be especially appropriate for the elementary level.

The second problem relating to short-term experiments is that there is a good chance the Hawthorne effect may be operating. "Almost any changes, any extra attention, any experimental manipulation, or even the absence of manipulation but the knowledge that a study is being done, is enough to cause subjects to change. In short, if we pay attention to people, they respond" (Kerlinger, 1964, p. 318). However, Block (1977b) argued that mastery proponents *want* to create a Hawthorne effect every day in schools. They deliberately try to introduce novelty in the *method* of instruction (through correctives) but *not* in the content that each student is required to master.

The narrow range of subject matter represented in the studies is a limitation of particular interest to teachers of such subjects as English, history, etc. One argument against mastery learning is that it is most appropriate for easily objectifiable, technical skills. Of course, one might still argue that mastery learning should be used for subjects to which it easily adapts. Among the studies in this review, 18 involved technical skill subjects--mathematics (14), science (2), auto mechanics (1), and grade 7 English-as-a-foreign-language (1). Only two *might* fall into the categories of the humanities or social sciences--language arts (at the primary level) and social studies. Again, Block (1977b) offered an explanation. Researchers started, he said, with subjects that would yield sequential units. He stated that work is currently progressing in the areas of the arts and humanities that suggests that mastery strategies work well for at least part of the curriculum. We await the results of these studies.

A third limitation involves the lack of thoroughness in the reporting of experimental conditions. Did the teacher construct the objectives, the formative and summative tests, and the correctives, or were commercially constructed packages used? What evidence exists that actual treatment, whether "home-made" or "store-bought", was educationally sound and suitable for the circumstances? A theory may be valid, but if the implementation is poor, the theory cannot be adequately tested. Recall the study by Anderson (1976a) where, after nine months of exposure to mastery learning methods, a large sample of students did exceptionally well on summative tests of computation but not so well on standardized tests of problem solving and concepts. Anderson admitted that the instruction had centered on the computation skills. Given the verified power of mastery strategies to direct a student's study time, teachers must carefully select objectives.

Conclusions

We mentioned that research has cast both a few shadows and much light on the issue of the potential of mastery strategies. Having dealt with the shadows, let us turn our attention to the light. From the results of studies considered in this review come the following conclusions, appropriate at least for the subject areas examined:

Achievement. The evidence definitely favors the mastery learning approach in the acquisition of cognitive skills in the subject areas examined.

Variability. Mastery learning has proven to be effective in reducing the amount of variability in achievement and retention within a group of students.

Retention and Transfer of Learning. While only a few studies examine these outcomes, the evidence favors mastery approaches.

Student Attitudes. Studies of affective outcomes, while few in number, favor mastery approaches.

Time Consequences. Mastery strategies seem to require much greater student study time, but there is some evidence to suggest that slower learners tend to learn more quickly as they progress through a series of mastery-taught units. Moreover, students have been found to spend a larger proportion of time in active learning when required to study to mastery.

Individual Differences in Entry Characteristics. In a few studies, mastery strategies have been shown to *minimize* the effects of student entry characteristics on subsequent learning. Very little has been done to explore the effects of measured I.Q. on a student's achievement under mastery strategies, but the evidence is favorable--i.e., mastery approaches tend to reduce the usual relationship between intelligence and achievement.

Mastery or Criterion Levels. The unit mastery requirement has been shown to have the strongest impact on student learning of any of the components of the strategy. When this requirement is not imposed or is set at a level lower than normally required for an A, the poorer and less similarly have students studied and learned. A 90 per cent level is the recommended optimum.

Correctives. There is a need for more data, but there were indications that practice is not as effective as reinstruction and reinvolvement in improving learning.

Implementation/Dissemination Materials. There is a limited number of materials now developed to assist in the dissemination and implementation of mastery strategies, both for pre-service and in-service teaching training.

4 Implementing Mastery Learning: Experiences of Practitioners

The research reported in Chapter 3 was primarily quasi-experimental; that is, the researchers usually selected control groups of students in such a way that the comparative achievement of these groups with those of mastery-taught students could be attributed reasonably to the type of instruction (the treatment) rather than to student, teacher, or curricular differences. It is always difficult in the social sciences to conduct true experimental studies, and this is especially the case in the field of educational research. Researchers rarely have the opportunity to match students and teachers and to assign them randomly to treatment groups. Nevertheless, one assumes that the researcher in quasi-experimental studies does assure that the treatment of interest is in fact implemented or used. In the case of most mastery learning research, then, we assume that teachers in the "mastery-taught" classes had been prepared to implement the strategy and that the researchers took steps to monitor classes to verify that the strategy was used.

In a sense, then, mastery learning researchers probably have served as in-service teacher trainers and as resource persons in implementation. It is fair to conclude that, when mastery strategies are implemented, student achievement improves significantly. The key to improved student outcomes under mastery systems is valid implementation, just as it would be under any innovative system of instruction. If teachers are not in agreement with what the system is attempting to do or, more importantly, if they are unable to change their usual pattern of instruction (i.e., adapt to a new role), then the innovation is not likely to be implemented properly and thus not likely to yield visible differences in student outcomes (see Fullan, 1972).

The kind of external professional assistance in implementation that likely was an element in most mastery learning studies would not be feasible on a widescale or sustained basis. Recall that, when Kim and his associates (1970) evaluated mastery strategies across nine schools, the notable inter-school variation in student outcomes was attributed to differences in school learning climates, in the cooperation of schools and teachers, and in the degree of efficient use of the instructional materials, as well as to the failure of some teachers to follow the mastery learning operating procedures. One can infer that, once the mastery strategy was developed and tested on a small scale, Kim and his colleagues were unable to monitor closely the system-wide implementation. The mastery-taught students across the system achieved significantly better than non-mastery-taught students, but it was clear that implementation differed among schools and individual teachers.

A Practitioner Survey

We were interested, then, in the experiences that practicing educators have had in attempting to implement mastery learning. Our intentions were to identify difficulties that practitioners have had in attempting implementation, to solicit advice that would facilitate implementation by others, and to assess the attitudes of practitioners about the system after having tried it.

Working from names suggested first by professors and later by practicing educators, we identified 39 educators in Canada and the United States who were known to have experience with mastery learning implementation. It was not feasible to conduct massive national surveys of educators and then to select randomly among the self-reported implementers. We have no way of knowing, then, how representative our sample was. A questionnaire was developed (see Appendix B) and was returned by 22 of the 39 persons. The respondents appeared to form a surprisingly good sample in terms of geography, occupational position, years of experience with mastery learning, subjects taught, and grades taught.

Five of the respondents were from Canada, and represented Ontario, Manitoba and Nova Scotia. From the United States came answers from

Oregon, Colorado, Illinois, Ohio and South Carolina. Three other respondents were unidentified, but it is believed that they were also from the United States. The elementary panel was represented by five teachers, eight principals, and three subject coordinators. At the secondary level, questionnaires were received from a principal, a vice-principal/teacher, three teachers and an ex-teacher who is presently a Ph.D. candidate. Oddly enough, all but one of the secondary schools were in Canada and all the elementary schools were in the United States. In terms of experience with mastery learning, the range was quite wide--from less than one year to 15 years. Ten of the respondents were in their second year of using the approach and another seven had from two to five years' experience (see Appendix C, Tables C1.-C4., for sample details).

From the sample of respondents, mastery learning seemed to be most popular in two subjects, mathematics and social studies. In these areas, the technique was employed at virtually all grade levels from kindergarten through grade 12. Physical education was the only other subject for which mastery learning use was reported at both elementary and secondary levels. Music, spelling, handwriting, and reading were mentioned only by elementary respondents; English, chemistry, science, and health were named only by those in secondary schools.

Introduction and Planning. The respondents were asked to identify the person or persons who made the decision to introduce mastery learning into their classes, schools, or school systems. Among the elementary group, the coordinators saw it as a district office decision, teachers saw it primarily as a cooperative decision involving both the district office and the school staff, while principals reported that the decision was made at the individual school level. In the secondary schools, mastery learning was usually introduced by interested principals or teachers on a small scale (see Table C5. in Appendix C). When asked what amount of time is required to prepare the curriculum before actually using mastery learning techniques, the most popular response by far was "considerable" (see Table C6.).

Explanatory comments of our respondents with reference to the planning time required verify what Block and Anderson (1975) admit and provide the basis for their encouragement to start small, experience

70

success, and thereby increase teacher commitment and motivation to broaden the use of the strategy. One elementary school principal explained:

> My teachers went through a low period when they were involved in the difficult and tedious task of writing their units. Then they were able to experience success in teaching the units, and so their work paid off.

Most of the comments were variations on the theme, and most seemed to indicate that the role of the principal is critical in providing support, in-service assistance, and setting realistic expectations. In the comments quoted below, there appear to be valuable pieces of advice to prospective implementers. The quotations are grouped according to a respondent's position--principal, teacher, and/or coordinator.

Comments from Principals

> A teacher must want to be willing to change--be willing to put forth extra effort. The principal must also be willing to attend in-service meetings, present the material to the faculty, and be a part of the instructional team.
>
> The first time a unit is taught it is time-consuming and takes much planning.
>
> It can be hard work and in that sense not attractive to every teacher. Motivation by way of college credit helped.
>
> Requires time to develop content objectives and consensus. Difficult to find time necessary for instruction. Requires re-training of many teachers.
>
> It requires voluminous record keeping.
>
> Be prepared to be willing to spend some extra time in implementing the plan.
>
> Take one subject area, one grade, highly motivated teachers, at first--then expand grade levels.

Comments from Teachers

> Most, if not all, of the teachers seemed to resent all the extra work and time involved (in the first year of implementation). . . . I am enjoying it much better this year, maybe because of less time needed to write the objectives and plans (i.e., correctives and enrichment activities).
>
> At first mastery learning was a real pain. It takes a lot of time to organize. Our school tried to do too much too fast, so our first year of it was really touch and go. . . . I would recommend to anyone contemplating beginning a mastery learning program to take at least one year to get things planned.
>
> In adopting mastery learning there must be enough time allowed for planning the work before it is started in the classroom. A year's work should be ready and need only minor changes as it is presented.

Comments from Coordinators

> When beginning to teach mastery, I would strongly suggest teachers begin working in *one* area--the easiest is math because of the sequence and concrete objectives which should be taught at various levels. Once a teacher has developed one unit and has taught the unit, it is very easy to apply the concepts to other subject areas.
>
> We had much to do in a very short period of time. Therefore, our initial planning was inadequate. Implementing a mastery learning program does involve adequate planning and much work.

Implementation Steps. From the discussion in Chapter 2, recall that there are four major steps that distinguish mastery instructional strategies from others: setting and sequencing objectives, developing summative and formative tests, setting performance standards, and planning and developing corrective procedures. Survey respondents were asked to identify the most difficult step in implementing mastery learning. Each of the four major steps was named by at least two respondents, but the development and use of tests appeared to cause the most difficulty (see Table C7. in Appendix C).

Some respondents offered specific advice with reference to setting unit and course objectives and developing tests, but they were not always in agreement. An elementary principal believed that it was better to use units developed by the particular teacher concerned "rather than somebody else's units." A secondary principal, however, disagreed. He preferred the use of objective banks with criterion-referenced tests that are commercially produced and adapted to the local situation "rather than trying to construct a taxonomy of objectives and corresponding tests from scratch." An elementary teacher cautioned:

> Be realistic. Many units will need to be rewritten because they just didn't work. Test items are difficult to write. Don't try to make them so complicated.

Other reasons given for the difficulties regarding tests were that students tire of frequent tests, that very young students need to have the test read to them, and that it was difficult to devise valid and reliable instruments. Recall that, in Block's experience, most teachers are not prepared by teacher training to develop criterion-referenced testing.

The leading proponents of mastery learning claim that it can be used with any subject matter, although it is easier to define instructional objectives and develop tests in some subjects than in others. Our elementary school respondents tended to agree with this claim; some felt that subjects such as math and science are particularly well suited. The following are comments from elementary principals and teachers:

> Math seems to be the subject most adaptable, but the process can be applied to all subject areas--including music and physical education.
>
> It is applicable to all subjects--students can be successful, and as far as I'm concerned all teachers should be involved.
>
> I think that mastery learning could be adapted to almost any situation (reading might be difficult) and grade level (kindergarten through college) with the most difficulty perhaps in kindergarten and first grade.
>
> Mastery learning is more suitable for 'skill subjects, e.g., reading, math' and for 'kindergarten to eight-year-old students'.

> Mastery learning has worked in almost all subject areas, but easier in math and science. Selecting desired student outcomes is most important in process subjects such as reading, writing.
>
> It works at all grade levels.
>
> We have been using it in social studies but I'm sure it can be used effectively in any subject.
>
> We have worked this theory into our social studies and our new reading lessons are presented in this way. Both are working.

Secondary teachers, however, state more precise limitations. One warned that "a 'social inquiry' curriculum is not suited to the rigor implied by the technology of mastery learning and concomitant progress steps." Another advised: "Cognitive material is best to use. It is difficult to use the mastery process with higher level learning processes (i.e., appreciation, analyzing) because higher level thought processes cannot be 'tested'." A secondary principal commented that science and math courses were certainly more amenable than others to the mastery learning approach.

Setting performance standards was the step that appeared to cause the least difficulty among our survey respondents, possibly because most merely accepted Block's advice in defining mastery as the level normally accepted as an A (85 to 90 per cent). Recall that Block recognized that, in some schools, it might be necessary to pre-define standards for a variety of marks (or grades), from A through F for example. One respondent (a secondary teacher) commented that it was best to limit the possible acceptable standards:

> Try offering fewer grade choices--that gives fewer options. If a student has a choice of only an A or a B, he/she will work to receive one of those because no other choices exist. There are exceptions (very few) simply because the teacher may not want or be able to spend the additional time to bring the last two or three (in my experience) students to A or B levels.

When asked about the methods and materials they used in the corrective process, a variety of answers resulted (see Table C8.). Peer tutoring and academic games were the most popular methods reported, while prepared worksheets and tapes were the materials mentioned most often. Other responses included the use of group work, drill, interview, charts, filmstrips, and alternative texts. A secondary teacher cautioned that teachers should manage this time themselves and not allow it to be student-directed time. In other words, the corrective process must be built into the regular classroom and not left to student initiative.

Teachers were asked about their management of students who have mastered a unit while other students are working on correctives. At the elementary level, the response given most often was the use of enrichment activities. In grade one social studies, these activities included "making small globe, model, etc.; listening station; cutting pictures out of magazines." These sorts of activities are not without drawbacks, as reported by a teacher of grades three and five social studies: "Book reports, art work, make games, research in library--all of these need the teacher and she needs to be re-teaching." A common practice in secondary schools was to let students go on to the next unit. Apparently in these cases the students were using programmed material. More sophisticated research and tutoring were also mentioned, but as one teacher states, "it is difficult to motivate them for enrichment or tutoring."

Finally, respondents were asked to compare the mastery learning approach with their previous approach to teaching from the standpoint of the time required to cover course content. Seven of the 14 respondents reported that mastery approaches took more time; of these, six were from elementary schools. Of those answering "the same time," however, four out of six were from secondary schools. The reason for the discrepancy between the two groups may be that the secondary teachers utilized programmed material for the initial presentation, which would allow the better students to progress on their own and free the teacher to help the poorer students.

Attitudes toward Mastery Learning. The amount of time and work involved in implementing mastery learning was a theme which appeared again and again in the survey responses, especially from the elementary school implementers. Mastery learning apparently requires a great deal of dedication, effort, and change on the part of the school staff, but one gets the impression that they feel it is all worthwhile. As one elementary teacher put it, "Mastery learning is a terrific plan. It is a necessary approach in learning any subject matter." Another teacher wrote that the plan helps instructors see where and when ideas work to accomplish their objectives. An elementary coordinator stated that both the teachers and pupils know what is expected of them: "Instruction is not left to chance." Mastery learning, according to an elementary principal, is a "good refresher for everyone in the area of educational theory. It provides an opportunity to make that learning theory real and practical."

Three principals and one teacher from the elementary panel commented about the positive impact of implementation on staff relationships and morale. In particular, the principals saw the system as providing a means for professional development. One of them wrote that mastery learning gives the principal or supervisor "some skills and a direction to go in improving instruction." Another commented that he found it "helpful in evaluating staff members because we spoke the same language, and the process is directed toward growth and development."

With reference to the improvement of staff and principal relationships, compare the responses of an elementary principal with that of a teacher (from another school):

> The staff here is on the same 'wavelength;' we speak the same language. In conference we can discuss strengths and weaknesses of the presentations. . . . I feel very close to my staff because I feel I am the instructional leader, can give direction to them, and be a part of providing a quality education to our students.
>
> Our school atmosphere as a whole began to be warmer, and we felt closer as we worked together to reach our children.

Student Reaction. Opinions regarding the effects on, and the reactions of, students to mastery learning all seem to be positive. However, secondary school respondents in particular added qualifiers to that assessment. An elementary principal reported that approximately 75 per cent of the students in his school were working at A level after one year of implementation. Nevertheless, he noted that there was some concern about "gifted" students not receiving as much teacher time as they had previously enjoyed. An elementary teacher reported that students seem to enjoy it when they do not have to do the correctives. An unqualifiedly positive response came from another elementary teacher:

> Even young students are quick to learn what having another chance means. They feel you are being fair and honest. Students with very little success before are able to master difficult material, and they are proud.

The reservations about student reactions expressed by two secondary teachers and a vice-principal seemed to reflect the fact that secondary students were expected to assume more initiative on their own to correct their errors in learning. The vice-principal stated that one possible danger is that students who do not complete the course content still may expect to receive course credit. "To avoid any problem, I kept parents informed with respect to what units the student has completed and what units he will have to complete." One of the secondary teachers reported that mastery learning can work, but "it is difficult to get students to believe that you will not cross them up on tests ('I didn't believe you'd test on what you told us to learn.')." This respondent also noted that students "take a while to get the feel of self-learning, and it is easy to lose patience with high school students. Be patient." Finally, another teacher reported that student "output" did not change, relative to grades, but there was evidence of increased student motivation, enthusiasm, and respect for subject and curriculum organization.

The Critical Role of Teachers. Regardless of the amount of effort one is willing to expend to make mastery learning work, its ultimate success will depend upon the ability of each teacher. One of the secondary school teachers was well aware of this, and listed five problems which some teachers seem to have:

1) Failure of teachers to understand theory; misapplication.

2) Tendency to emphasize content acquisition rather than problem-solving ability.

3) Difficulty on teacher's part to not ignore diagnostic/formative tests and to appreciate their role in the monitoring of the learning process.

4) Lack of comprehensiveness in summative tests (do not test objectives, or only part of stated purpose, etc.).

5) Inability to write objectives and translate curriculum into instructional units.

An elementary principal reported on what he believed were necessary ingredients for successful teaching. Teachers, he said, must have an understanding of, and a commitment to, mastery learning, be child-oriented, and truly try to individualize their instruction. Another principal was more terse in his advice, but quite emphatic: "Internalize the philosophy." A secondary teacher also emphasized the need for teachers to understand and to believe in the philosophy: "Believe all students can learn and will learn. Be patient--results will come."

Special Implementation Cases

One of our respondents was kind enough to send a report documenting the experiences of the staff and students of a school during their first year with mastery learning implementation. Because we believe that many people will find this interesting and helpful, we have reproduced the full report in Chapter 6.

Another respondent wrote at some length of his own rather unusual situation. As it could not be properly appreciated in a summarized version, we will present the entire set of comments from this secondary teacher.

> Mastery learning has a place but should not be considered a be all, end all. The given situation here is as follows. It is a large reservation with no economic base. Unemployment runs at 90+ per cent. There is some apathy to life in general (partially manifesting itself in alcoholism) and to education specifically in some cases. Families tend to be large, houses very small.
>
> Attendance on the whole is not very good compared to typical southern schools. Some students miss a considerable amount of time and homework is difficult for a number of students due to home life/facilities.
>
> Capable students could end up repeating a subject indefinitely if the classroom situation required all students to be at the same place at the same time. Since repeated 'failures,' or alternatively 'social passes,' are both unacceptable, mastery learning is a viable solution at this time.

Limitations: Run out of time sometimes when over 20 students show; also hard to motivate some students to work on their own; keeping track of all students and re-explaining some things many, many times.

Strength: Designed to help student, definitely, or I feel very few teachers would try it. Students can go on to next grade in subject area at his convenience which is beneficial. It may take two years to pass course; better than failing twice.

Suitability: Don't know about grade eights or under, but in senior the older students seem better suited (more mature).

Advice: Different teachers would react differently. *It isn't easy!* but worth it when results show positively. Class size important, e.g., if regular attenders number more than 20 perhaps grouping might be more useful.

A third implementation case is presented in the next chapter. In the opinion of the principal investigator, the Chicago Mastery Learning Reading Program provides a model for implementation that reduces significantly many of the difficulties that teachers have in developing units, tests, and correctives.

Concluding Remark

It was earlier stated that the 22 respondents on whom we have reported appeared to form a fairly representative sample. This is not entirely true. The people who were sent questionnaires were those presently involved with mastery learning and, therefore, presumably committed to its successful implementation. This sense of commitment is apparent in their comments. What is lacking in this survey is a voice from the opposing side. We have no idea how many educators have tried the approach and found it lacking. All that can be said for certain is that many people have put mastery learning to the test and found that, in the words of one teacher, "It works!"

5 The Chicago Mastery Learning Reading Program

There have been many efforts initiated by school districts or boards to implement mastery learning systems. Among these, the Chicago Mastery Learning Reading Program is probably best known in the educational community because of papers presented to American Educational Research Association annual meetings and because of a recent article in the *Phi Delta Kappan* (Smith and Katims, 1977). The principal investigator visited the Chicago project and interviewed the Director, Michael Katims. The discussion that follows includes descriptions of the project's objectives, the project team, the development of the program, its impact on students, and the impact of the program on teachers.

Project Objectives

Smith and Katims (1977, p. 199) have described vividly the reason for the establishment of an experimental mastery reading program in Chicago:

> Each summer Chicago girds itself for its two regularly scheduled disasters: the Chicago Cubs and the newspaper publication of reading test scores. Though the overwhelmingly complex and arduous task of improving the Cubs is readily comprehended by the Chicago citizenry, they *do* get testy from time to time about those reading scores . . . . In fact, the problem of low reading achievement in the Chicago Public Schools is both chronic and pervasive; it affects nearly all areas of instruction and seems resistant to a variety of remedies.

The Chicago Mastery Learning Reading Program (CMLRP) began in 1975 as an experimental project designed to combat the problem of low reading achievement. The goals of the project were to adapt the mastery learning strategies developed by Bloom (1968) and Block (1973) to Chicago's reading curriculum and to develop a program based on this theory, that could be implemented easily and inexpensively in the large urban school system. Both objectives proved challenging.

In adapting the mastery strategy to Chicago's reading curriculum, the developers first had to be sensitive to the major components of the strategy itself--formal specifications of a comprehensive set of cognitive objectives; instruction; frequent formative/diagnostic evaluation; corrective or remedial instruction; and criterion-referenced summative evaluation. Applying this strategy to reading, the developers have argued, is more difficult than it would be in other areas such as mathematics, science, or foreign language instruction. In the latter subjects, the content is relatively new to all students, minimizing the problem of coping with different prior achievements in the area. Further, the subjects can be broken down neatly into learning units, and the units can be sequenced logically (see Katims *et al.*, 1977).

In the case of reading, the end product (literacy) is clear, but it is extremely difficult to establish a comprehensive set of cognitive objectives as means to that end. The difficulty arises not so much in terms of scarcity of available objectives but rather in terms of selecting an optimum route from amazingly varied sets of objectives identified from numerous reading systems. Moreover, the content of most systems of teaching reading is only gradually sequential. Mastery of one unit does not really depend upon mastery of a previous unit. As Smith and Katims (1977, p. 200) argue, "Thus, while there *is* a cumulative payoff in mastering successive units in reading, this payoff occurs much more slowly than in other courses."

The project's second objective, to develop a mastery program that could be implemented easily and inexpensively in a large urban system, also proved to be challenging. Smith and Katims developed the following list of the constraints they faced as the project progressed:

> 1. Since urban pupils vary greatly in background and ability, the program had to be flexible enough to accommodate cultural diversity and be usable by pupils of different ages at the same reading level.

> 2. The program could not require a large financial investment for implementation or expect considerable auxiliary classroom resources; it had to be usable by a single teacher with up to 35 pupils.
>
> 3. Teachers vary in expertise, especially with respect to teaching reading. The program had to be sufficient for the minimally competent or inexperienced teacher, though not inhibitive to the exceptional teacher.
>
> 4. The program had to be usable within the confines of the regular school day, since it would be unrealistic to assume that pupils requiring extra work would do it outside of class. (p. 200)

In short, the program had to be practical and teachers had to be able to use it with minimal training (one-two hours) and with no external assistance. Finally, the program had to improve student reading ability (Katims, 1978).

The Project Team

The experimental project was organized in the Department of Research and Evaluation of the Chicago Board of Education, which is physically located in a former elementary school building. In Katims's words, the project started "on a shoestring," with three F.T.E.'s (full-time-equivalent positions). They have been re-funded at roughly the same level each year since.

The full-time staff is supplemented by unit writers and material developers who work at a daily rate that is quite low. These persons, according to Katims, are "from everywhere." Their occupational backgrounds range from secretarial work to professional artist. The artist is a well-known cartoonist whose work appears in national magazines, but he was enthusiastic about the mastery program. His cast of animal characters created for the kindergarten materials now being developed has provided the focus for the entire effort. Services of part-time assistants like these are almost of a voluntary nature.

Finally, the unofficial and unpaid staff includes five teachers and their students from the Raymond Elementary School in Chicago. Katims (1978) noted that the formal project staff were the "experts" in mastery learning, creating the materials and organization needed for implementation.

> Because these teachers were the 'experts' in what Philip Jackson calls 'Life in Classrooms' (1968), we let them provide us with the feedback we required to make the program practicable. They kept us aware of the needs we ought to address; they made suggestions for improvements, and they never hesitated to let us know when we made mistakes.

Because the objective was to design a program that could be implemented easily, the five teachers in the experimental stage were *not* volunteers and were given only minimal preparation. Nevertheless, their contributions to the project were invaluable, according to Katims.

Development of the Program

The Curriculum Department of the Chicago Board of Education has developed curriculum objectives, guides, and materials for a comprehensive range of subject areas and year levels. (The board has issued a *Catalog of Curriculum Publications*, 1976, which lists guides and materials that are available for purchase.) The public schools have been operating under a continuous progress system for many years. Thus, levels A-B are kindergarten; levels C-D are roughly equivalent to grade 1, etc. Teachers are given appropriate curriculum guides which define the objectives for the subject and level they are to teach. The guides define performance formats, according to Katims, but they do not recommend an instructional system nor do they include criterion-referenced tests. Teachers in the system are also given record-keeping cards which list the relevant objectives. As a student masters an objective, the teacher punches the appropriate spot on the record card. Thus, the Chicago public schools have claimed to be on a mastery learning system for some time, although the mastery learning *instructional* system was not developed on a large scale until the CMLRP was initiated in 1975.

Katims's team wanted to create an instructional system adapted to the Chicago reading objectives, of which there were hundreds arranged in blocks that represented roughly a half-year's worth of instruction. Textbook publishers had been asked to identify books or sections of books that were relevant to particular Chicago reading objectives. The CMLRP team examined these sources as well as teacher guidebooks issued by textbook publishers. None of these materials offered a comprehensive instructional system. That is, they all told *what* to teach and suggested a myriad of curricular materials, but they did not speak to the issue of *how* to teach reading.

Katims (1978) has summarized the dilemma faced by reading teachers daily and by the project team in attempting to provide assistance:

> Reading instruction, like all instruction, is complicated by factors in school life which are beyond the control of the teacher. Curriculum and textbook decisions, weekly school schedules, class characteristics (e.g., size, homogeneity, ability level), physical realities--all of these influence classroom instruction by limiting the plans and decisions available to teachers. Still, the critical problem in planning for and making decisions in the process of *reading* instruction is not that the teacher is too constrained. Rather, the problem is one of an embarrassing overabundance of instructional materials, coupled with a critical shortage of information about how and when to use them to conduct effective and efficient instruction. In no other school subject are there so many materials, of so many types, and from so many sources as in reading. . . . Yet the teacher is given no guidance about how to select and organize these materials to create a comprehensive program of reading instruction.

The CMLRP team started their work by organizing the Chicago reading objectives for levels E, F, G (roughly grades 2-3) into two types of learning units: skills units and comprehension units. The skills units consist primarily of word attack and study skills objectives; the comprehension units usually focus on a more generalized comprehension objective such as "making comparisons." After organizing the objectives into units, instructional materials for each unit were developed to follow the mastery learning components. Both types of units contain the same kinds and sequences of instructional materials:

> 1. *A guide to initial instruction.* This is a thorough "script" to the instruction of the skill being taught. It contains instructional *cues* to be presented to the learner about what skills are being taught, why they are important, how the pupils will be asked to demonstrate mastery, and what steps they will go through to get there. Most units include a series of two or three teaching activities in a sequence designed to lead the learner to acquire the skills. Each of these teaching activities has its own guide to instruction.
>
> 2. *Student activity sheets.* The teacher receives ditto masters of student worksheets that accompany each instructional activity. In doing these

> individually and going over them as a class, the pupils have an opportunity to practice the skills being taught.
>
> 3. *Formative test.* Each unit includes a formative test for which mastery levels are provided. This test provides feedback to the teacher and pupils with respect to progress in the unit and guides the remediation to follow.
>
> 4. *Remediation.* The teacher is also given ditto masters for remedial exercises for those who need them. These are designed to provide additional instruction (usually in a more pictorial or concrete mode), additional practice, and something similar to additional testing. They are designed to be done by the pupil alone, with the teacher roving through the classroom to assess progress and provide help at specified checkpoints in the exercises. Remediations on different objectives can be worked upon by different pupils simultaneously. Thus the teacher can give help to those who need it at the point where they are having difficulty.
>
> 5. *Additional activities.* As pupils achieve mastery of the unit, they are given one of two types of additional activity: high-interest, appropriate level reading materials (books, magazines, etc.), or dittoed "enrichment activities" (puzzles, games, things to make or do). These activities are intended to motivate pupils toward mastery and give them further reading experience. When pupils have mastered the unit, they may also help with remediation (peer tutoring). (Smith and Katims, 1977, pp. 200-201)

The CMLRP consists of three basic parts: reading from a basal reader (this can be *any* reader that is available), skills units, and comprehension units. The program was designed so that teachers can arrange these three components during the week "to fit their teaching style and the needs of their classroom, but of the time they devote to reading, they are asked to spend approximately one-third on each of these three activities" (Katims *et al.*, 1977). Reading materials other than basal texts can be used for that component.

As the program was tried out in the Raymond School, the project team learned that stories in basal readers are independent of the skills instruction in the accompanying units. For example, a unit might teach "ea" words but the story might not be filled with such words. If the team tied progress through the skills units with stories, they found that pupils would read from their readers only once every two weeks since they were working on and remediating skills. Thus, teachers were asked to think of their reading week in terms of 10 segments (two per day) instead of the usual five. They were asked to use three or four segments per week for each of the activities of the program. Consequently, a hypothetical week of reading instruction might look like this:

	Monday	Tuesday	Wednesday	Thursday	Friday
First Segment	S**	S**	S**	S**	C***
Second Segment	R*	C***	C***	R*	R*

* R = Reading
** S = Skills Unit
*** C = Comprehension Unit

In practice, teachers can modify the number of segments spent on each of the three components to meet the class needs. If a class is doing well on one component and not on another, the teacher may wish to spend more time on the latter. Because the three components are independent of each other, moreover, the class can proceed from unit to unit on the component they are mastering easily without being encumbered by their slower progress on another. Since stories are not tied to skills units, teachers may select reading materials that complement the comprehension units being taught or that are of particular interest to the class.

In short, the program was designed so that each classroom reads from its basal reader (or other material chosen by the teacher) three or four times a week, and each classroom can move through each skills unit and comprehension unit at its own pace, moving to a new one as they "master" each unit. (Katims explained to the principal investigator that they do not hold each student responsible for mastery of each unit in reading since it is unclear that the skills in a particular unit are essential to the end objective of literacy; this might not be the case in mathematics where unit mastery is essential to mastery of the next hierarchical unit.)

At the completion of any one unit, a pupil will have worked through from one to three worksheets, a two- to three-page formative test, and (for some) a two- to four-page remediation exercise. Thus all children in the CMLRP get more verbal experience than those in a traditional program, and those pupils who most need it get still more experience. Finally, the program was designed so that an implementing school can use whatever reading materials it already possesses, needing in addition only a set of manuals for the teacher and ditto paper for the pupils (approximately $13.00 per *class*, per year). Ditto masters are included with the manuals.

Teachers require very minimal instruction in how to use the program. In the case of the Raymond School experiments, the teachers were first given a copy of Block and Anderson's book (1975) and a paper on the program, although the project team doubts that more than two teachers read either document (Katims *et al.*, 1977). The teachers assigned to take part in the experiment attended a ninety-minute meeting at which they were told about the program, given their materials, and were told about how the three components were to be integrated. Katims *et al.* (1977, p. 11) reflected, "It was clear at the meeting that they found the array of materials, recording forms, and instructions both overwhelming and somewhat intimidating. In the future, when an operating manual exists, this indoctrination should go much more easily."

Teachers in the experiment were given a week to become familiar with the materials and to begin to establish the program in their classrooms. The project staff then met with each teacher during one or two of the teacher's preparation periods. After those meetings, staff members visited each classroom periodically, observing and soliciting feedback, or soliciting advice on new units being developed.

In reflecting upon the process of development, Katims said that there is no "magic formula." Left on his or her own as curricular and instructional developer, the teacher's task is arduous. The project team wanted to relieve individual teachers of this task but, at the same time, the units they developed had to be usable by 500 schools and some 3,000 teachers.

The team approached the task by asking, "How are we going to teach for this objective?" and "How do we test for mastery of this objective?" The instructional and evaluative processes must be compatible, so the questions are interrelated. As each unit's instruction and evaluation was developed, the team field-tested it in a "handful" of classes. "We listened to the kids and to the teachers, then evaluated it, and modified it," according to Katims. They tried to develop a variety of formats for the corrective or remedial activities.

In a workshop setting, they have asked teachers to take particular objectives and go through the process that they have used. They found that this procedure illustrates how people define ends differently and thus teach differently. After a group has developed one format for instruction, they are asked to take the objective and develop an alternative instructional format. This kind of workshop serves to prepare teachers for the development of "correctives." It also served to reinforce the alternatives that the project team had developed.

The skills and comprehension units that were designed by this development process were field-tested and refined. At the moment, a complete set of materials for Levels FG (roughly grades 2-3) and HJ (grades 3-4) are prepared. Copies of the tables of content and sample units for Level FG are included in Appendix D. We are unable to include material from the teachers' manuals for Level HJ. The complete set of units will likely be available for purchase from the Chicago Board of Education in the future. The CMLRP is now being implemented for Levels FG and HJ in some seventy-odd schools in Chicago and involves around 125 teachers and more than 3,000 pupils. Units are now being developed for kindergarten, grades 1-2, junior high school, and for upper levels.

The junior high materials will receive a full-scale field-testing this summer. While the principal investigator was in Chicago, the school board announced an end to "social promotion" and mandated that, at the end of grades 3, 6, and 8, students not reading at the expected level will not be promoted and will be required to attend a summer reading program. The grade 8 students so affected number around 15,000 of the 40,000 students in that grade last year. Around 10,000 high school students will be taking a similar program to improve reading skills. Another 20,280 public and nonpublic school pupils who are economically disadvantaged likely will attend a summer reading program that is seeking Federal funding.

The junior high school summer reading program will be using some newly developed materials from the CMLRP. These include some experimental

88

units that attempt to teach learning strategies and study skills. The materials then will be modified to serve all city schools next year. Katims noted that it will be most difficult to evaluate the new kindergarten materials since the diagnostic and summative testing must be done on an individual basis. As they move into secondary levels, the difficulties will be more in the nature of organizational constraints. The CMLRP is now being moved into the Curriculum Department of the Board since its program has proven itself and implementation will now be city-wide. The task of developing the reading program for all levels will continue.

The CMLRP staff do not claim that the Chicago reading curriculum is a superior one or that the instructional materials they have developed are better than one might find elsewhere.

> What we do have is a *system* for presenting instruction to pupils and for making instructional decisions. The system is based on a theory that has been successful in other areas, a system that has as its explicit goal the achievement of reading success for all students. We have tailored the theory to meet the needs of a specific population in a specific subject.

Impact on Students

During the first year of the project, only five classes in a single school participated in the development of the system. Smith and Katims (1977, p. 202) reported that the five teachers "suffered through false starts, rough draft materials, and a 'system' that was modified weekly." Nevertheless, the pupils in these classes showed an estimated 30 per cent increase in rate of learning. The rate of learning was *not* slowed for the "faster" pupils. The overall variance among pupils decreased, while the correlations between prior ability and performance on unit formative tests steadily declined. Further, evaluation of the initial year's trial implementation showed that teachers were enthusiastic about continuing.

The initial evaluation also satisfied some of the concerns about the project. The program was not hindering the faster pupils. It was not always the same pupils who needed remedial help on the various units. Teachers found the program to be practical and helpful.

During the following year (1976-77) the program was implemented in 10 schools, and an experimental evaluation design was planned. Two classrooms in each school with pupils at the appropriate reading level for the available materials were to be selected. In each school, one classroom was to be selected randomly for CMLRP implementation, and the other classroom would be designated a control group (in which reading instruction would be taught in the usual way). Because of problems in gaining school staff cooperation in random assignment, the study became quasi-experimental (in five schools, either the principal or the teachers selected the "treatment" classrooms) and the study involved 10 CMLRP classes and eight "control" classes. A total of 474 pupils participated. Pre-tests at the beginning of the year revealed that the "control" groups entered with higher performance levels than did the groups assigned to mastery-taught classes.

The pre-test and post-tests were the Iowa Tests of Basic Skills (reading comprehension). All pupils were given the test in the fall of 1976, 15 weeks after the instruction began, and again in the spring of 1977. In just 15 weeks, the CMLRP classrooms went from about one month behind the controls to being slightly ahead of them. (See Smith and Katims, 1977.) Further, achievement in the CMLRP was less dependent upon prior ability as mastery learning theory predicts. That is, the correlation between reading gain and prior achievement (as measured by the September score) was significantly smaller in the mastery classes than in the controls. When classrooms rather than individual pupils were used as the unit of analysis, the results showed the CMLRP to be significantly superior, even though there was a bias against those classrooms (in terms of pupils being generally older and having lower prior achievement levels).

Although the results of the spring 1977 testing have not been published, Katims told the principal investigator that substantial gains in achievement had been found for the mastery-taught students. At the end of seven months of instruction, the test scores of CMLRP students revealed a seven-month gain, while the control students had gained only four months, and the average gain of all relevant pupils across the city was only three months.

In the spring 1977 evaluation, the project team also compared the scores of the highest and lowest 20 per cent of both "treatment" and "control" groups (in terms of their pre-test scores). They found that control students in the lowest prior achievement group had made almost no progress during the year, while the mastery-taught students in the lowest group had made great progress. The mastery-taught students in the highest prior achievement group did better than the respective control students, but their gain was not significantly superior. Having satisfied themselves that the system was not detrimental to the "faster" students, the project team was relieved. The mastery system, Katims maintains, "worries most about 90 per cent of the pupils, not the upper 10 per cent."

During the 1977-78 year, the CMLRP was implemented in some 54 schools, so the team now has evaluative data on more than 3,000 pupils. These analyses are not yet available, but the success thus far has established a firm base of support for the program. As mentioned, it will now be implemented system-wide.

In discussing why the program has enjoyed success in terms of improved student achievement in reading, Katims explained that they had observed that pupils in Levels EFG (grades 2-3), under traditional teaching, are usually placed in reading groups. The groups primarily spend their time reading. There is no real *instruction* in reading. Under the CMLRP, on the other hand, the teacher instructs the entire class (Katims admits that this involves something akin to lecturing in the elementary classroom), the pupil then works on related activities, and then a formative test determines what the pupil does next. Learning is organized to be more efficient, and all pupils get more practice than ever before. Under traditional systems, Katims has observed that the pupils who need less instruction usually get more of it; the mastery system reverses this situation so that those pupils who need more get more. Thus, time and instructional resources are allocated according to pupil need.

Pupils are not under pressure to "cram" for formative tests. This is because the formative test is actually part of the instructional system. This also explains why it is inappropriate, in terms of mastery learning rationale, simply to allow a student to delay writing a formative (unit) test until he/she is "ready," or to allow students to re-write tests at various times during the term (while the class as a whole is moving on to other units). Those who succeed initially simply go on to enrichment activities (such as materials designed to improve reading rate) while others go into remediation (or correctives).

Pupils at this level seem to need the material to be learned broken down into manageable chunks, and they need lots of repetition, according to Katims. Thus, he argues that the most sensitive and most difficult part of a mastery system is designing the alternative activities (correctives). They have designed very structured remediation activities that pupils do mostly on their own, with the teacher going up and down the rows to assist if needed. The additional activities primarily give the pupil more practice and more instruction. The materials are often more concrete than in the initial instruction. For example, one additional activity for learning about prefixes has the pupil cut out words and prefixes and move them around. The most difficult corrective to use, but one of the most effective, is peer tutoring.

Impact on Teachers

The five teachers in Raymond School who were selected to participate in the experimental implementation of the CMLRP were not volunteers and, as noted, seemed fairly bewildered by the mass of materials given them at the orientation workshop. After the first year, these teachers were enthusiastic about continuing. The results they were obtaining were great motivators. Smith and Katims (1977) reported that teachers involved in the quasi-experimental study the following year also were not informed of their participation until the fall of the year of implementation. Yet those who were chosen to implement the CMLRP are also positive about continuation. Several of them have told the project team that "textbooks in other subjects (such as science) that could not be used before, because of the difficulty of reading level, are now being taken off the shelves and used successfully."

What do teachers need to implement the CMLRP? As noted earlier, the financial investment for a school and/or teacher is very minimal, since all one needs is the set of manuals for the teacher and ditto paper for the pupils. In terms of teacher training, Katims believes that a single day of in-service, combined with a follow-up visit after implementation has begun, is sufficient.

The primary reason for the minimal in-service required lies in the nature of the program. Smith and Katims (1977, p. 200) explained that the CMLRP is basically quite straightforward:

> No prior grouping is required on the part of the teacher, instruction is laid out in detail, identification of pupils who need remediation and what skills they need help on is done by objective testing, and the amount of remediation and materials for the remediation are provided. Since the class is taught as a whole (with individualized remediation), preparation for reading instruction by the teacher is a *single* preparation rather than multiple preparations.

Katims (1978) admitted that, during the development of the program, "we were as unconcerned with teacher planning and decision making as the paucity of literature shows the rest of the research community to be." However, he now has concluded that the most distinctive aspect of the program that was developed is not the collection of materials provided for teachers, but rather the explicit guidance given on how and when to use them. This guidance, while not restricting a creative teacher, helps teachers delineate and organize instructional decisions. This, in turn, greatly facilitates planning.

We referred earlier to the array of reading materials available to teachers and to the lack of guidance given to teachers in how to select and organize these materials into a cohesive program of reading instruction. With the CMLRP, the teacher is relieved of these problems. Unlike some programmed instructional systems, however, the CMLRP does not eliminate the need for teacher planning and decision making; it is rather a help in those important areas. A mastery learning model, according to Mueller (1976), "systemizes a series of instructional components which taken together constitute high quality of instruction." It is the program as used by the teacher, according to Katims (1978), that translates the theoretical model into a practical teaching tool.

In terms of decision making, the CMLRP primarily focuses on decisions that teachers must make after they have been teaching for some time. Teachers must decide when to stop teaching one topic and begin another, but they need feedback about the effectiveness of their instruction to that point in order to make this decision. The formative test provides such feedback. If most of the pupils have not yet mastered the material, the class as a whole needs additional instruction and/or practice. Usually, however, many have mastered but some have not.

93

Thus teachers have another decision to make--what to do for those pupils who need additional help. If the additional learning opportunities are to occur within class time, teachers must also decide what to do with those pupils who were successful on the unit test.

These additional decisions (on alternatives/correctives and enrichment activities) seem to complicate instructional planning. Katims (1978) admitted that mastery learning instruction is more complicated because it is more ambitious than is traditional instruction. The underlying philosophy in mastery instruction is that nearly all students can achieve *if* they are provided the opportunities they need. Thus the mastery learning model specifies the elements of instruction which need to be planned for as well as the critical instructional decisions that need to be made.

While the teacher manuals in the CMLRP include a guide to initial instruction that is a "script," teachers do not have to use them *verbatim* unless they wish to do so. The project team has found some teachers eliminate some of the instructions or examples if they deem them unnecessary or expand on the examples if their classes seem to need it. The guides, however, have been created for typical classrooms and teachers. The CMLRP *is* sufficient for teachers "who are less sure of their footing in teaching reading," because it helps inexperienced teachers make difficult but critical instructional decisions (Smith and Katims, 1977).

Teachers, then, use the manuals and student activities as they see fit. Further, in integrating the components of the program (reading, skills, and comprehension), the teacher may decide to spend more or less time on any one than on another, according to class needs. Finally, the program does not mandate particular reading materials. Teachers are free to select materials of appropriate interest levels and can be sensitive to the cultural characteristics of their classes in selecting reading materials.

Although the project team did not consider teacher planning and decision making in their initial units development, the five Raymond School teachers made significant contributions to the process. They influenced the program, according to Katims (1978), so that it addresses the primary problems that teachers face in organizing reading instruction. Katims noted that, when practitioners influence educational innovators, they do so from a practical perspective. The teachers' roles in influencing the development of the CMLRP helped to eliminate threats or inhibitions of teachers.

From the evaluations of teacher responses to implementation, Katims (1978) concluded that teachers are quite receptive to a system which facilitates their planning and decision making. To be of practical help to teachers, such a system required both materials and an organization structure. He also recommends that such a system be developed through simultaneous pilot-testing with the cooperation of target practitioners. Since mastery learning instruction is more complicated than regular teaching, successful mastery learning courses probably must contain both the materials and the organization that teachers need to make the decisions that are required by the theoretical model and by the particular content of their subject area. These needs, Katims argues, will vary across content areas and educational levels.

Summary

In short, the Chicago Mastery Learning Reading Program itself and the developmental processes used by the project team in creating the program provide models for future developers, whether they be individual teachers, school staffs, or school-system coordinators/consultants. The impact of CMLRP on both teachers and students has supplied solid support to mastery learning theory. Since reading may be one of the most difficult subject areas to adapt to the mastery learning model, their work has also provided evidence that the model can work with any subject.

6 Implementing Mastery Learning in Social Studies: One School's Report

With the kind permission of Alvena Smarr, Coordinator of Pine Tree Hill School's "Mastery Learning in Social Studies Project," we reproduce below the report of the first year of implementation. The report is dated July, 1977.

Mastery Learning in Social Studies: The First Year

We at Pine Tree Hill School have just completed our first year of a three-year federally funded project, called Mastery Learning in Social Studies. I will discuss the progress and pitfalls of the first year from the viewpoint of someone on the front lines. Although I was not responsible in any form for the project proposal which formed the skeleton for our first year, I have lived and worked within the school since the project funding and am therefore responsible for the program management and mis-management during the first year.

The Mastery Learning in Social Studies Project in Camden, South Carolina, is a result of the efforts of the school district to improve their social studies program. The various social studies had not been organized district-wide to form a total social science inter-disciplinary approach. The sequential building of the social studies skills and the integration of these skills with the total elementary skills program had not been undertaken. The mean social studies achievement for the district was three months below the national norms in grades 2 and 3, four months below in grade 4, and five months below in grade 5. (CTBS, Social Studies Sub-test.)

A search for a systematic approach to curriculum development resulted in the selection of mastery learning as the model around which the social studies curriculum would be built. The group-based mastery learning approach, where each child learns cooperatively with his classmates, was chosen rather than the individually based format. The district selected one elementary school to develop a comprehensive social studies curriculum that would serve as a model for other schools in the district and in the state.

This school is the largest elementary school in the district, with approximately 700 pupils, 35 teachers, one principal, and one curriculum coordinator.

The project received a federal grant, Title 1V-C, for the proposed three-year developmental period.

Pupils. The pupils at Pine Tree Hill perform below the national average on the Comprehensive Test of Basic Skills in both reading and math. The school receives funds from ESEA, Title 1. Most parents of Pine Tree Hill pupils work in textile factories surrounding the school. Approximately 80 per cent of the pupils are white, 20 per cent black.

Teachers. Of the 26 regular classroom teachers participating in the project, nine have their Masters Degrees, the other 17 have their Bachelors Degrees. The median age of the teachers is 33. The teacher turnover rate is quite small. (All of the 35 teachers are returning next year.)

Structure. The average class size is 26. We have four kindergarten classes, five classes each at grades 1-4, and four fifth-grade classes. Approximately five para-professionals serve the school as teacher aides.

Project Objectives

These are the main project objectives:

Product Objectives

1. To increase social studies achievement of all project participants as measured by a standardized achievement test.
2. To help students achieve mastery of social studies content.
3. To help parents and pupils increase their understanding of, and satisfaction with, the social studies program.

Process Objectives

1. To specify and design for mastery instruction all social studies content for grades K-5.

2. To construct instructional units which contain the components of the mastery learning paradigm.
3. To implement the mastery learning strategy in all social studies classes in grades K-5.

The focus of my remarks will be on the process objectives.

These process objectives called for these specific activities during the first year:

1. Teachers were to be trained to use the mastery learning approach in the planning and teaching of social studies.
2. Teachers were to write social studies units for the entire school year which would include the mastery learning components.
3. The mastery learning plan was to be completely implemented in all grades with all units taught the first year.

Pre-Service Workshop

Teachers met with the mastery learning specialist and social studies consultant for three hours each day for three weeks for these purposes:

A. To gain an understanding of the assumptions underlying teaching for mastery. To learn the skills needed for the following activities: selecting objectives, preparing tables of specifications, writing lesson plans which correspond to the objectives, designing correctives, designing enrichment activities, and writing both formative and summative tests which adequately assess the objectives.

B. With the aid of the social studies consultant, teachers were to have gained these skills and understandings: an awareness of the major content areas in social studies, an understanding of the skills to be developed in these content areas, and skills for integrating value clarification techniques into the teaching of social studies.

In addition to the above knowledge and skill areas, teachers were to have accomplished these tasks by the end of the workshop:

1. Select the social studies content areas for grades K-5.
2. Select the units to be taught for each grade level.
3. Arrange the units in the order in which they would be taught.

4. Prepare the lesson plans which will include all mastery learning components.

Since I assumed that most teachers already possessed many of the prerequisite skills, I felt that the objectives of the workshop were realistic.

A discussion of our efforts to achieve the workshop objectives will follow.

Selecting the Content. The general content for the entire year was to have been selected before the actual unit preparation was to have begun. From the first we experienced difficulties in selecting content. New textbooks had been ordered for all district schools. Not only was the content unfamiliar to the teachers, but the series stressed the sociological-psychological areas, a radical departure from the former textbooks whose emphasis was on the traditional areas of history, geography, etc. During the workshop, teachers had neither the time nor interest to fully explore these and other resources to select the content for a school year.

Unit Construction. Most teachers at our school had little experience in writing objectives, instructional plans, or test items. Naturally, variability existed in the teachers' skills and abilities. The simple approach would have been to choose those teachers who evidenced the most readiness in these areas and train them to plan and design the units. After all, the *explicit* goals were to develop mastery learning units and to implement them as facilitative learning experiences for students. However, an *implicit* goal (of mine) was to have teachers mobilize their energies and direct their efforts so that the instructional process could become more effective. Thus, my decision was to involve all teachers in the unit construction. I felt that teachers should achieve mastery in this phase so that they would be better able to understand and apply the mastery learning components.

Our unit preparation has the following components, i.e., these are the steps teachers at one grade level follow in writing the units:

1. Unit Content. The concepts, information facts, information relationships, and procedures to be taught for mastery are listed.

2. Division of Unit into Clusters. The unit is then divided into small 2-3 day teaching segments which we call "clusters."
3. Table of Specifications. For each cluster, a table of specifications identifies the objectives for each cluster.
4. Plan A. "Plan A" is a detailed lesson plan which teachers may follow in the initial presentation of the material in one cluster to the class. This plan may involve the use of audio-visual aids and a variety of other techniques, but it is predominantly teacher directed toward the entire class. It often includes plans for students to practice the skills introduced.
5. Formative Test A. This test is prepared from the table of specifications with one or more items for every entry in the table.
6. Plan B. "Plan B" is a detailed lesson plan for those students experiencing difficulty as manifested by their performance on the formative test. These "correctives" typically present the material in a different sensory mode or in a different form of the same mode than those used in Plan A. Peer tutoring is one technique used in Plan B for students in grades 3, 4, and 5.
7. Enrichment Activities. The enrichment activities include lesson plans for those students who demonstrate mastery of the cluster objectives on Test A. While the content remains the same, students are involved in application and analysis skills as they tutor other students or complete other activities which involve these higher level skills.
8. Formative Test B. The items in this test parallel those in Test A. This test is designed to allow the slower learners who failed to master Test A to have a second chance. It also provides the teacher and parents with diagnostic information.
9. Steps 3-8 are repeated for each cluster until plans for the entire unit are complete.
10. Summative Test. The items in the summative test, in general, parallel those in the formative tests. However, some items are generally included which assess the student's ability to analyze the concepts or relationships in the several clusters.

> In most cases a review cluster will provide opportunity for students to practice these skills (pull everything together) before the summative test.

Team members at each grade level shared the responsibility for constructing a unit. Each teacher was assigned a cluster and was responsible for writing plans, designing correctives and enrichment activities, and writing test items for that cluster. We used a highly structured approach in constructing the units. We had specific forms which teachers used as they were writing each segment. For example, for Plan A, the form had these categories: content, methods of communication, props, and practice activity.

Results. At the conclusion of the workshop, we had a *rough* copy of our content scope and sequence for grades K-5. We had a *very rough* draft of the first mastery learning units for all grade levels.

Pre- and post-tests to evaluate the effectiveness of the workshop revealed that teachers' skills had improved in the various areas involved in constructing mastery learning units. An attitude scale revealed that teachers believed that mastery learning would be a more organized method of teaching than their previous methods and that the mastery approach would be an effective instructional ploy. They evidenced considerable apprehension about the amount of work involved in planning.

Recommendations. There were far too many activities planned for the allotted time. The selection of content should involve considerable thought and effort. Naturally, if a school system has appropriate curriculum guides with the scope and sequence, and objectives clearly defined, then the task of content selection is greatly simplified. Otherwise, this phase should be accomplished before the mastery learning workshop is held.

Similarly, if systematic planning for instruction is considered a necessary part of the total instructional responsibility of teachers, planning for mastery is greatly simplified. Unfortunately, my experience has been that many teachers have difficulty in building the bridge or relationship between objectives, plans, and evaluation. As an illustration, one teacher of a fourth grade social studies class included in her lesson plans coloring activities, regardless of the concept to be taught. Another included having third graders memorize (with correct spelling, of course) the names of the planets in order of their nearness to the sun. The objective was to have pupils recall that planets are heavenly bodies that revolve around the sun.

Assuming the ideal conditions of an adequate curriculum guide (or pre-planning) and adequate teacher skills in lesson planning, the length of the workshop could be reduced somewhat. Probably the greatest single aid to a successful workshop would be to provide at least two units from different grade levels, complete in every detail, so that teachers will have a concrete model to examine before they begin constructing their first unit.

Implementation

Unit Construction. The project guidelines for the remainder of the year called for teachers to implement the mastery learning strategy in all classes to all pupils in grades K-5 and to write units for the remainder of the school year. During the *teaching* of each unit, the teachers were *writing* the instructional plans for the *next unit*. At each grade level the team leader was responsible for coordinating the efforts of the other team members. He/she was released from his/her teaching duties for five hours each week in order to devote the extra time to planning for mastery instruction.

At all grade levels every effort was made to give each teacher the opportunity to read and criticize each component of the mastery learning plan. The unit plans were then reviewed by the team leader and project coordinator before being sent to the social studies consultant for additional input. The plans were then typed, duplicated, and placed in booklet form for each teacher. Each booklet contained copies of all handouts, tests, and worksheets to be used during the unit.

Orientation. Each teacher was responsible for orienting his/her class to the mastery learning strategy. The new vocabulary was introduced and the use of formative tests was discussed. A special newsletter and a PTO meeting helped to orient parents to the mastery learning program. At the start of the first social studies unit, a second newsletter was sent to the child's parent indicating the content of the unit the child would be studying and how the parent could help his child achieve mastery.

Instruction. During the teaching of the units, the following activities occurred: (1) Frequent team meetings were scheduled to aid the teachers in following the mastery learning plans; (2) Teachers and project office personnel recorded scores of all formative tests, pre-tests, and summative tests; (3) Teachers recorded the amount of time spent on the various instructional activities; (4) Observations were made of social studies instruction by the project coordinator. Even with detailed lesson plans, some teachers manifested difficulty in following them. For example, some teachers had difficulty in drawing subconcepts together to form a generalization. Again, I can only conjecture that these "sins of omission" were less frequent than if teachers were haphazardly following plans which they did not help create. "Sins of Co-mission" were no less frequent with teachers including activities of interest to them which bore little or no relationship to their defined objectives. Feedback and discussion with individual teachers were provided after each classroom observation.

Modification of Units. Frequently, teachers added instructional activities not included in the plans but designed to facilitate the acquisition of the goals. Every effort was made to encourage this practice. During the teaching of a unit, each teacher kept notes of activities that appeared particularly effective as well as those that appeared ineffective. Considerable modification of lesson plans and test items occurred throughout the instruction. At the end of the school year, the team leaders and project coordinator made further revisions based on these notes. Item analyses were performed on all summative tests. The results of the item analyses were used to aid in the modification of the tests.

Modification of Content. The new textbooks were both a barrier and a boost to our social studies program. They created a barrier by introducing unfamiliar content and neglecting such content areas as map and graphing skills, economics, and government; they provided an impetus by encouraging teachers to design their own instructional units using resources other than the textbook. In general, the units which created the most enthusiasm in both teachers and pupils were those created entirely by us. Therefore, though the new textbooks created anxiety initially, they contributed to our selecting content and developing curricular experiences more suitable to the needs of our pupils.

In-Service Training. Teachers received three in-service days during the year. Activities were planned so that teachers could meet by grade level with the mastery learning consultant and social studies consultant both of whom provided the periodic feedback and reinforcement so badly needed during the first year. One in-service day was devoted entirely to the construction and use of manipulatives for social studies instruction.

Results. We found our system of involving all teachers in unit construction quite time-consuming, partly due to the fact that teachers seldom had the opportunity to meet during the school day as a group. Our system enabled a greater percentage of teachers to master the skills of designing mastery learning units, not without frustration by all of those responsible for revising and correcting others' work. Whether this method encouraged teachers to utilize the plans and materials to a greater extent than they would have if others had designed the materials, we cannot say. I certainly believe this to be true. From the results of a process evaluation instrument administered to the teachers, we found that over 80 per cent of the teachers responded to the question of "What do you consider the strengths of the project?" with the answer, "Detailed lesson plans." "Mastery learning gives learners a second chance" was the second most popular response.

Since the unit construction was a rather slow process, we failed to reach the project goals of having all units designed for mastery and implemented during the first year. While the pupils failed to receive a full school year's instruction in social studies, it is a safe assumption they received at least as much as they would have under the former school policy.

Recommendations. The activities during the year should be sequenced so that teachers have the opportunity to master one step before proceeding to another. Teaching one unit while writing another unit was quite confusing, especially during the first year of the project. Teachers should be involved in only one major activity at a time in the following order: planning, teaching, evaluating, and revising.

The guidelines of our project necessitated our attempting to plan and construct one unit while teaching and evaluating another unit. I would never recommend this method. The ideal solution for developing curriculum would probably be to plan, construct, teach, evaluate, and revise one unit before starting another. Unfortunately, time requirements would be prohibitive and few people would wish intentionally to cause such a lack of continuity in the instruction of pupils.

Perhaps the most realistic approach in a public school setting would be to reserve the first year for planning. During the preservice workshop, teachers would design the first mastery learning instructional unit. At the beginning of the school year the mastery learning unit would be taught (piloted) and afterward teachers could return to their usual methods of teaching. The unit could then be revised and the remainder of the school year could be used to construct the additional mastery learning units. This experience of teaching one mastery learning unit is invaluable for planning other units. In-service days should be planned so that teachers have an opportunity to meet with the other team members, with the social studies and mastery learning consultants, and with the project coordinator as needed. I have found that in a school climate the amount of work accomplished is inversely linearly related to the number of people in the work group--the larger the group, the less work accomplished. However, in the initial planning, weekly team meetings are crucial. Our efforts at involving all teachers in the construction of unit plans, resulted in increased skill at such activities and in the teachers' feeling a sense of pride as a group because of their joint accomplishment. We also feel that the teachers have more interest in teaching the materials than if they had been prepared by others. Undoubtedly, a more efficient procedure, from the standpoint of unit construction, would be to select those teachers who demonstrate a particular skill (item writing, constructing manipulatives, record keeping) and assign responsibilities based on this skill. If this selection process is used, it should not occur until all teachers have had the opportunity to help in the construction of all components of one unit.

Perhaps the most difficult area in the implementing of a mastery learning model is the constructing of assessment devices. Test construction takes considerable skill and time. Although our tests had been examined by many teachers and other educators, we found that the first test administration to pupils provided the best information concerning the quality of the items. If possible, all summative tests should be pilot tested before being administered for purposes of evaluating the project or determining pupils' grades. Item analyses should be performed to gather further information helpful in revising the test.

The mastery learning model includes plans for *frequent* testing, although at the lowest grade levels these tests are both difficult to construct and difficult to administer in a group situation. Testing kindergarten, first-, and second-grade pupils provided the greatest challenge. A variety of evaluative procedures, many of which are informal, must be used in lieu of the usual paper and pencil test. Considerable creativity and skill are needed to design such tests. Both the frequency and length of tests must be reduced, at the expense of gaining needed information.

Product Evaluation

The results of the product evaluation will be only briefly mentioned. It is not my intention to underrate the importance of evaluating cognitive and affective product objectives, but I question the wisdom of placing a great deal of emphasis on product evaluation during the first developmental year.

Objective One. The first product objective was to have 70 per cent of all pupils achieve mastery on the summative tests. The present criterion for mastery was 85 per cent correct. Our results indicated that only 54 per cent of all students achieved mastery. The only grade meeting the objective was our kindergarten, which had 79 per cent mastering the summative tests. I found these results very promising considering our failure at constructing perfect tests during our first attempts. Since I will estimate that at least 40 per cent of our test items underwent drastic revision after the first administration, I am quite surprised that over 50 per cent of our pupils mastered the content.

Table 4 presents the numbers and percentages of students achieving (or not achieving) mastery on the summative tests. Data is presented by grade level.

TABLE 4

NUMBER OF STUDENTS MASTERING SUMMATIVE TESTS

Grade	Total No. Students	Achieving Mastery		Not Achieving Mastery	
		No.	%	No.	%
K	90	71	79	19	21
1	101	47	47	54	53
2	96	61	64	35	36
3	104	37	36	67	64
4	112	47	42	65	58
5	105	65	62	40	38
Total:	608	328	54	280	46

Objective Two. To have all pupils achieve mean scale scores significantly higher than would be expected for untreated normative sample students. This objective was assessed by using the Standard Achievement Tests, Social Studies Subtest in grades 2-5 and the Stanford Early School Achievement Tests, Environment Subtest, in kindergarten and first grade.

The tests were administered in the fall and then again in the spring. The no treatment expectation was that the project pupils would maintain, at post-testing, the same achievement status with respect to the norm group as they had at pre-testing. If their post-test status is higher, the assumption is made that the improvement resulted from participation in the special project.

Results. Data from grades 2-5 indicate that mean scale scores on the post-test were significantly higher than would be expected for untreated normative sample students. Table 5 presents Z-scores on the differences between expected and actual mean scale scores on the Stanford Achievement Test.

TABLE 5

Z-SCORES FOR DIFFERENCES BETWEEN EXPECTED AND ACTUAL MEAN SCALE SCORES ON THE SOCIAL STUDIES SUBTEST OF THE STANFORD ACHIEVEMENT TEST

Grade	Total No. Students	Mean S.S. Test	Percentile Rank Pre-test	Actual Mean S.S. Post-test	Expected Mean S.S. Post-test	Gain	Z Score	Sig.
2	108	113	14	123	115	8	5.56	.05
3	103	126	38	139	135	4	2.53	.05
4	111	125	16	142	131	11	2.53	.05
5	100	148	38	164	158	6	2.79	.05

Data from kindergarten and first grade indicate that only grade one achieved a mean raw score on the post-test that was significantly higher than would be expected for untreated normative sample students. Students at the kindergarten level did not achieve the stated objective.

TABLE 6

Z-SCORES FOR DIFFERENCES BETWEEN EXPECTED AND ACTUAL MEAN RAW SCORES ON THE SOCIAL STUDIES SUBTEST OF THE STANFORD EARLY SCHOOL ACHIEVEMENT TEST (FORM A)

Grade	Total No. Students	Mean Raw Score Pre-test	Percentile Rank Pre-test	Actual Mean Raw Score Post-test	Expected Mean Post-test	Gain	Z Score	Sig.
K	102	23.89	30	29.12	31	-1.88	-3.24	.05
1	124	23.36	40	26.57	25	1.57	3.20	.05

Objective Three. Parents and pupils will have shown an increase in their understanding of, and will have increased their satisfaction with, the social studies program.

An attitude scale was administered to parents in the fall and in the spring. The responses to each item of the test, a three-point Likert Scale, were examined separately since no attempt was made to construct a unidimensional scale. The results indicated that parents differed significantly on four of the 15 items. In essence, after the first year, parents felt they had a better idea about how their children were doing in social studies. They also believed their children were learning more of the necessary social studies skills and were bringing home more work. On the other hand, parents felt they might be getting too much information concerning the skills their children had in social studies.

The Social Studies Questionnaire was administered to students in grades 3-5 as a pre-test and as a post-test. This scale was a three-point Likert with the three possible responses: "yes, no, maybe." The teacher read the test items to the class. Two subscales emerged from the factor analysis. Two additional items were analyzed separately. In both subscales (attitude toward social studies and working with others), the mean dropped significantly from pre-test to post-test. Item 7 revealed that students were less upset if their work was wrong. Item 9 revealed that the students were not as afraid to ask their teachers for help.

Summary. Our first year is over. In retrospect, I believe it has been a good one, which is not to say that I would not do many things differently if I could relive this year.

I do not believe the staff at Pine Tree Hill is atypical in any way. Some are hard-working conscientious teachers and some are not. Some teachers are fast learners and some are slow. I do not believe that I had one teacher who did not benefit from the project, which means the students will benefit also. I think the skills learned from our social studies project will have a tremendous impact on other subjects. For example, teachers are now spending time constructing tests for other subjects--tests which assess more than mere factual recall. Two grade levels are beginning their planning next year for a mastery learning approach to the teaching of math. The school selected new reading texts for next year and selected a series which uses the mastery learning approach.

During our first year, the development of our units was the primary consideration. Next year, the focus will shift to the instructional process. We are looking forward with great excitement to next year. Most of the tedious work is behind us. We have our outline, our direction. Now we can concentrate on fitting together the mastery learning components to make it work for our pupils.

References

Anderson, W. "Time and School Learning." Unpublished Ph.D. dissertation, University of Chicago, 1973.

Anderson, W. "The Effects of a Mastery Learning Program on Selected Cognitive, Affective, and Interpersonal Variables in Grades 1 Through 6." Paper presented at the annual meeting of the American Educational Research Association, San Francisco, April, 1976. (a)

Anderson, W. "An Empirical Investigation of Individual Differences in Time to Learn." *Journal of Educational Psychology*, vol. 68, no. 2, 1976, 226-233. (b)

Arlin, M. N. "The Effects of Formative Evaluation on Student Performance." In H. F. Crombag and D. N. DeGruijter (Eds.), *Contemporary Issues in Educational Testing*. Paris: Mouton, 1974.

Biehler, R. *Psychology Applied to Teaching*. Boston: Houghton Mifflin, 1974.

Block, J. H. "The Effects of Various Levels of Performance on Selected Cognitive, Affective, and Time Variables." Unpublished Ph.D. dissertation, University of Chicago, 1970.

Block, J. H. (Ed.) *Mastery Learning: Theory and Practice*. New York: Holt, Rinehart & Winston, 1971.

Block, J. H. "Student Learning and the Setting of Mastery Performance Standards." *Educational Horizons*, vol. 50, no. 4, 1972, 183-191.

Block, J. H. "Teachers, Teaching, and Mastery Learning." *Today's Education*, vol. 63, 1973, 30-36. (a)

Block, J. H. "Mastery Performance Standards and Student Learning." Unpublished study, University of California, Santa Barbara, 1973. (b)

Block, J. H. *Schools, Society, and Mastery Learning*. New York: Holt, Rinehart & Winston, 1974.

Block, J. H. "Learning for Competence," The John Smyth Memorial Lecture, Victorian Institute of Educational Research, Melbourne, Victoria, Australia, August, 1977. (a)

Block, J. H. Address, Mastery Learning Workshop. Sharbot Lake High School, Sharbot Lake, Ontario, 1977. (b)

Block, J. H. "Individualized Instruction: A Mastery Learning Perspective." *Educational Leadership*, vol. 34, no. 5, 1977, 337-341. (c)

Block, J. H. "Motivation, Evaluation, and Mastery Learning." *Educator*, vol. 19, no. 2, 1977. (d)

Block, J. H. "The 'C' in CBE." *Educational Researcher*, vol. 7, no. 5, 1978, 13-16.

Block, J. H. and Anderson, L. W. *Mastery Learning in Classroom Instruction*. New York: Macmillan, 1975.

Block, J. H. and Burns, R. B. "Time in School Learning: An Instructional Psychologist's Perspective." Paper presented at the annual meeting of the A.E.R.A., Washington, D.C., March 30, 1975.

Block, J. H. and Burns, R. B. "Mastery Learning." In L. S. Shulman (Ed.), *Review of Research in Education*, vol. 4., Itasca, Illinois: F. E. Peacock and the American Educational Research Association, 1977, 3-49.

Bloom, B. S. *Stability and Change in Human Characteristics*. New York: John Wiley and Sons, 1964.

Bloom, B. S. "Learning for Mastery." (UCLA-CSEIP) *Evaluation Comment*, 1968, 1, 2.

Bloom, B. S. "Mastery Learning and Its Implications for Curriculum Development." In E. W. Eisner (Ed.), *Confronting Curriculum Reform*. Boston: Little, Brown, 1971.

Bloom, B. S. "An Introduction to Mastery Learning Theory." In J. H. Block (Ed.), *Schools, Society, and Mastery Learning*. New York: Holt, Rinehart & Winston, 1974.

Bloom, B. S. "Implications of the IEA Studies for Curriculum and Instruction." In A. Purves, and D. Levine (Eds.), *Educational Policy and International Assessment*. Berkeley: McCutchan Publishing Co., 1975, pp. 65-83.

Bloom, B. S. *Human Characteristics and School Learning*. New York: McGraw-Hill, 1976.

Bloom, B. S. Keynote Address, annual meeting of the Ontario Association of School Administration Officials, Sudbury, Ontario, 1977. (a)

Bloom, B. S. "Affective Outcomes of School Learning." *Phi Delta Kappan*, vol. 59, 1977, 193-198. (b)

Bloom, B. S.; Davis, A.; and Hess, R. *Compensatory Education for Cultural Deprivation*. New York: Holt, Rinehart & Winston, 1965.

Bloom, B. S.; Hastings, J. T.; and Madaus, G. F. *Handbook on Formative and Summative Evaluation of Student Learning*. New York: McGraw-Hill, 1971.

Board of Education, City of Chicago. *Curriculum Guide in Reading for the Elementary School*, 1974.

Board of Education, City of Chicago. *Catalog of Curriculum Publications*, 1976.

Brandt, R. "On Mastery Learning: An Interview with James Block." Educational Leadership, 1976, 584-589.

Burrows, C. K. and Okey, J. R. "The Effects of a Mastery Learning Strategy on Achievement." Paper presented at the annual meeting of the American Educational Research Association, Washington, D.C., March-April, 1975.

Carroll, J. B. "A Model of School Learning." Teachers College Record, 1963, 64, 723-733.

Carroll, J. B. "School Learning Over the Long Haul." In J. D. Krumboltz (Ed.), Learning and the Educational Process. Chicago: Rand McNally, 1965.

Collins, M. "A Strategy for Mastery Learning in Modern Mathematics." Unpublished study, Purdue University, Division of Mathematical Sciences, 1970.

Dolan, L. "The Status of Mastery Learning Research and Practice." Administrator's Notebook (U. of Chicago), vol. 26, 1977-78, 1-4.

Fiel, R. L. and Okey, J. R. "The Effects of Formative Evaluation and Remediation on Mastery of Intellectual Skills." Journal of Educational Research, vol. 68, no. 7, 1975, 253-255.

Fullan, M. "Overview of the Innovative Process and the User." Interchange, vol. 3, no. 2-3, 1972, 1-46.

Galloway, C. Psychology for Learning and Teaching. New York: McGraw-Hill, 1976.

Greene, M. and Bridges, J. Mastery Learning Project. North Clackamas School District Title III Project. Final Evaluation Report, Portland, Ore.: Northwest Regional Educational Laboratory, October, 1975.

Guilford, J. P. "A Revised Structure of Intellect." Reports from the Psychological Laboratory of the University of Southern California, 1975, no. 19.

Harnischfeger, A. and Wiley, D. Teaching-Learning Processes in Elementary School: A Synoptic View. Studies of Educative Processes, no. 9, University of Chicago, February, 1975.

Harvey, K. and Horton, L. "Bloom's Human Characteristics and School Learning." Phi Delta Kappan, vol. 59, 1977, 189-193.

Hymel, G. M. and Gaines, W. G. "An Investigation of John B. Carroll's Model of School Learning as a Basis for Facilitating Individualized Instruction by Way of School Organizational Patterning." Paper presented at the annual meeting of the American Educational Research Association, New York City, April 8, 1977.

Jackson, P. Life in Classrooms. New York: Holt, Rinehart & Winston, 1968.

Jones, F. W. "The Effects of Mastery and Aptitude on Learning, Retention, and Time." Unpublished Ph.D. dissertation, University of Georgia, 1974.

Katims, M. "Teacher Planning and Decision Making with the Chicago Mastery Learning Reading Program." Educational Comment, 1978.

Katims, M.; Smith, J. K.; Steele, C.; and Wick, J. W. "The Chicago Mastery Learning Reading Program: An Interim Evaluation." Paper presented at the annual meeting of the American Educational Research Association, New York City, 1977.

Kerlinger, F. N. Foundations of Behavioral Research. New York: Holt, Rinehart & Winston, 1964.

Kersh, M. E. "A Strategy for Mastery Learning in Fifth Grade Arithmetic." Unpublished Ph.D. dissertation, University of Chicago, 1970.

Kim, Y. et al. A Study of the Bloom Strategies for Mastery Learning. Seoul: Korean Institute for Research in the Behavioral Sciences, 1969. (In Korean.)

Kim, Y. et al. The Mastery Learning Project in the Middle Schools. Seoul: Korean Institute for Research in the Behavioral Sciences, 1970.

Kim, Y.; Cho, G.; Park, J.; and Park, M. "An Application of a New Instructional Model." (Research Report No. 8) Seoul: Korean Educational Development Institute, 1974.

Lavin, D. E. The Prediction of Academic Performance. New York: Russell Sage Foundation, 1965.

Lee, Y. D. et al. "Interaction Improvement Studies on the Mastery Learning Project." (Final Report on Mastery Learning Program, April-November 1971.) Seoul: Korean Educational Research Center, Seoul National University, 1971.

Mueller, D. J. "Mastery Learning: Partly Boon, Partly Boondoggle." Teachers College Record, vol. 78, no. 1, September, 1976, 41-52.

Okey, J. R. "Altering Teacher and Pupil Behavior with Mastery Teaching." School Science and Mathematics, vol. 74, no. 6, 1974, 530-535.

Okey, J. R. "Development of Mastery Teaching Materials." (Final Evaluation Report, USOE F-74-2990.) Bloomington, Indiana, August, 1975.

Okey, J. R. and Ciesla, J. Teaching for Mastery. National Center for the Development of Training Materials in Teacher Education, Indiana University, 1975.

Popham, W. J. Educational Evaluation. Englewood Cliffs, New Jersey: Prentice-Hall, 1975.

Ryan, D. W. "Individualized Instruction." Paper presented to the Principals' Course sponsored by the Ontario Ministry of Education in Sudbury and Peterborough, Ontario, Canada, 1972.

Ryan, D. W. "Review: Proposed NIE Research on Oregon CBE Program," mimeo., 1975.

Ryan, D. W. "Improving Teacher-Principal Relationships: A Sociological Approach." Education Canada, 13, 1973, 25-29.

Ryan, D. W. The Education of Adolescents in Remote Areas of Ontario. Toronto: Ministry of Education, Ontario, 1976

Ryan, D. W. and Greenfield, T. B. The Class Size Question. Toronto: Ministry of Education, Ontario, 1975.

Sarason, S. B. The Culture of the School and the Problem of Change. Boston: Allyn & Bacon, Inc., 1971.

Smith, J. K. and Katims, M. "Reading in the City: The Chicago Mastery Learning Reading Program." Phi Delta Kappan, vol. 59, 1977, 199-202.

Smith, J. K. and Wick, J. W. "Practical Problems of Attempting to Implement a Mastery Learning Program in a Large City School System." Paper presented at annual meeting of the American Educational Research Association, San Francisco, 1976.

Spady, W. G. "The Sociological Implications of Mastery Learning." In J. H. Block (Ed.), Schools, Society, and Mastery Learning. New York: Holt, Rinehart & Winston, 1974.

Spady, W. G. and Mitchell, D. E. "Competency Based Education: Organizational Issues and Implications." Educational Researcher, vol. 6, no. 2, 1977, 9-15.

Thurstone, L. L. Primary Mental Abilities. Psychometric Monographs, 1938, no. 1.

Wentling, T. L. "Mastery Versus Nonmastery Instruction with Varying Test Item Feedback Treatments." Journal of Educational Psychology, vol. 65, no. 1, 1973, 50-58.

Wick, J. W. "1976 Citywide Test Score Release." Board of Education, City of Chicago, Mimeo., 1976.

Appendix A: Features of Experimental Research

Table A1.
FEATURES OF EXPERIMENTAL RESEARCH FOR WHICH REPORTS WERE AVAILABLE

Author	Grade	Subject	Duration/ No. of Units	Sample	Measured the Effects of	Other Measures	Presentation	Correctives	Results
Anderson (1976b)	8	Mathematics	3 days 3 units	3 classrooms 29 mastery students 53 control students	Individual differences on learning time	I.Q., Prior Achievement	Programmed Text	Review exercises. Student tutorial help on third attempt.	1. Ratio of slow to fast learners was reduced from 34:1 to 2.1:1 over 3 units. 2. Students (mastery & control) who reached the criterion level on the first attempt spent significantly less time on Units 1 & 2 than did mastery students who needed more help. But on Unit 3, there was no significant difference.
Block (1972)	8	Mathematics	5 days 3 units	64 mastery 27 control	Selected criterion levels (95%, 85%, 75%, 65%) on: (a) achievement (b) retention (c) transfer (d) learning rate (e) interest (f) attitude	Pre-tests of achievement, transfer, interest, attitude	Programmed Text	Review "material." Student tutorial help on third attempt.	a) *Achievement:* Significant difference favoring ML at 85% and 95% levels. b) *Retention:* Same as for achievement. c) *Transfer:* Significant difference favoring ML at 95% level. d) *Learning Rate:* More time required by ML group (significance not reported). e, f) *Interest, Attitude:* Increased from 65% to 75% to 85%, but dropped off at 95% (significance not reported).
Collins (1970) (abstract)	8	Mathematics	Not reported	6 classrooms 125 mastery 25 control	Type of correctives on achievement	Pre-tests of achievement and of some course objectives	Instruction by teacher (?)	*Group 1:* List of objectives. *Group 2:* Objectives plus problem-testing objectives of previous lesson. Discussion of problem. Specific prescriptions for using text, class notes and handouts. *Group 3:* Objectives, diagnostic problems, review prescriptions. Alternative resources (texts, workbooks, games, SRA kits). *Group 4:* Problems, review prescriptions. *Group 5:* Problems. *Group 6:* Control (nothing extra).	*Groups 2 and 3:* 80% reached criterion *Group 4:* 70% reached criterion *Group 1:* 60% reached criterion *Group 5:* 50% reached criterion
Fiel, Okey (1975)	8	Science	6 days 3 units	4 classrooms 60 mastery 30 control	1. Mastery learning on achievement 2. Type of corrective on achievement	Mathematics aptitude test	Tape-slide program	*Group 1:* Additional instruction. *Group 2:* Additional practice. *Group 3:* Control (nothing extra).	1. Significant difference favoring ML over control. 2. Significant difference favoring Group 1 over Group 2.
Hymel, Gaines (1977)	HS	Mathematics	Not reported 2 units	64 mastery 77 control	Mastery learning on achievement	I.Q.	Instruction by teacher	"Additional exercises."	1. Achievement: Significant difference favoring ML. 2. Achievement/I.Q. correlation: Mastery .29, Control .48.

Table A1.–Continued

Author	Grade	Subject	Duration No. of Units	Sample	Measured the Effects of:	Other Measures	Presentation	Correctives	Results
Kersh (1970) (abstract)	5	Mathematics	4-5 weeks 1 unit	24 classrooms Mastery: 6 advantaged classes, 6 disadvantaged Control: Teachers' previous year's classes	Mastery learning on achievement	None reported	Instruction by teacher	"Alternative learning resources."	1. Advantaged: 75% achieved criterion, previous year 19% (sig.) 2. Disadvantaged: 20% achieved criterion, previous year 0 (sig.)
Kim *et al.* (1969) (abstract)	7	Mathematics	8 sessions 1 unit	136 mastery 136 control (approximate)	Mastery learning on achievement	I.Q. Prior Achievement	Instruction by teacher	Remedial programmed instruction. Review questions in small group study sessions. Student tutors (volunteers).	1. 74% of ML group reached criterion 40% of control group reached criterion. 2. Below average I.Q. (<93): 50% ML, 8% control. Above average I.Q. (?): 95% ML, 64% control.
Kim *et al.* (1970) (abstract)	7	Mathematics English (as a foreign language)	8 weeks Not reported	9 schools 2900 mastery 2900 control (approximate)	Mastery learning on achievement	Diagnostic test of learning deficiency	Instruction by teacher	Same as above.	Math: 61% of those reaching criterion were ML students, 39% control. English: 72% of those reaching criterion were ML students, 28% control.
Okey (1974)	3-4	Mathematics	2 weeks 1 unit	5 classrooms 66 mastery 64 control	Mastery learning on achievement. Mastery learning training on teacher attitudes toward tests, grades, diagnostic teaching.	Pre-test of teacher attitudes	Instruction by teacher	"Additional instructional materials."	1. Significant difference in achievement favoring ML in one of four groups. 2. Significant improvement in teacher attitude to tests, grades, and diagnostic teaching.
Wentling (1973)	HS	Auto Mechanics	5 weeks 8 units	6 classrooms 3 mastery classes 3 control classes	Mastery learning & choice of feedback on (a) achievement, (b) retention, (c) attitude to instruction, (d) learning time	I.Q.	Instruction by teacher	Restudy of booklets. Feedback variation.	*Achievement:* ML significantly favored. No significant difference between feedback types. *Retention:* ML significantly favored. No difference between feedback types. *Attitude:* No difference between ML and control. Partial feedback significantly favored. *Learning Time:* Control group significantly favored. (ML took 50% longer.) Significant difference between total feedback (least time) and no feedback (most time).

Table A2.
FEATURES OF EXPERIMENTAL RESEARCH GATHERED FROM SECONDARY SOURCES [1]

Author	Grade	Subject	Duration	Sample	Measures	Level of Learning[a] Achievement	Level of Learning[a] Retention	Variability of Learning[b] Achievement	Variability of Learning[b] Retention	Interest/Attitude Toward Subject Matter[a]	Academic/ General Self-Concept[a]	Cooperative Attitude/ Academic Confidence[a]
Anderson (1976a)	1-6	Mathematics	9months	24 classrooms 195 mastery students 195 control students	Achievement Retention (4 months)	6-0 (3-15*)	3-2	6-0 (17-1*)	5-0	5-4	1-2	
Block (1973b)	8	Mathematics	1 week	2 classrooms 27 mastery 15 control	Achievement Retention (2 weeks)	3-0	3-0	2-1	3-0	0-3		
Burrows and Okey (1975)	4-5	Mathematics	2 weeks	4 classrooms 63 mastery 21 control	Achievement Retention (2 weeks)	1-0	1-0	1-0	1-0			
Jones (1974)	7	Social Studies	4 weeks	20 classrooms 206 mastery 190 control	Achievement Retention (3 weeks)	0-1	1-0					
Kim et al. (1974)	2	Moral Education Korean Mathematics	2-4 weeks 8 months	20 classrooms 906 mastery 576 control	Achievement	2-0		0-1				
Lee et al. (1971)	5,6	Mathematics Science	Not reported	179 classrooms 7409 mastery 5095 control	Achievement	4-0		3-1				2-0
Okey (1975)	Primary	Mathematics Language Arts	4 weeks 1 semester	14 classrooms 356 mastery 356 control	Achievement	7-7		9-5				

---

[1] Adapted from James H. Block and Robert B. Burns, "Mastery Learning," in L.S. Shulman (ed.), *Review of Research in Education*, volume 4, pp. 14-15, 17, 26-27. Itasca, Illinois: F. E. Peacock and the American Educational Research Association, 1977.

[a] The first number in each pair denotes the number of comparisons made in which the mastery group significantly surpassed the central group. The second is the number of comparisons *not* favoring the mastery group at a significant level.

[b] The first number in each pair denotes the number of comparisons made in which the variability in the mastery group was significantly less than in the control group. The second is the number of comparisons *not* favoring the mastery group at a significant level.

[*] Comparison based on results of standardized tests.

Appendix B: Questionnaire on Mastery Learning

MASTERY LEARNING

1. What is your present position (e.g., teacher, superintendent)?

   ____

2. Are you presently involved with some application of Mastery Learning?

   ____

3. Total (cumulative) experience with Mastery Learning:

   __________ or __________
   Years Months

4. During your own experience with Mastery Learning which grades were involved?

   ____

5. Who made the decision to introduce Mastery Learning into your class/school/school system?

   __________ I made the decision more or less on my own.

   __________ The decision was made by others. (List positions of those involved and include yourself, if applicable.)

   Further explanation, if needed: ____________________

   ____

   ____

The most important question we have is this: Does Mastery Learning work? We have reserved page 3 for answering this question.

Teachers: Please answer the questions on page 2 before proceeding to page 3.

Others: You may find that reading over the questions for teachers on page 2 will facilitate your answering the question on page 3.

FOR TEACHERS ONLY

6. What is the longest period of time you have used Mastery Learning with any one group of students?

7. With what subjects and grades have you employed Mastery Learning?

Subject ______ Grade ______ Subject ______ Grade ______

Subject ______ Grade ______

8. Amount of time required to prepare the curriculum before actually using the Mastery Learning techniques:

______ very little time

______ moderate amount of time

______ considerable amount of time

9. From a teacher's point of view, the most difficult aspect of Mastery Learning involves:

______ instructional objectives

______ performance standards

______ frequent tests of material

______ corrections

Briefly, the reason is: ____

____

10. What kinds of methods or materials did you use as correctives? Please list them and check (✓) which one(s) have been most effective.

( ) ________________

( ) ________________

( ) ________________

( ) ________________

( ) ________________

11. After some of the students have mastered a unit, what do they usually do while waiting for the other students to reach the level of mastery? Do you find this to be wholly satisfactory?

____

____

____

12. Comparing the Mastery Learning approach with your previous approach, were you able to cover the course content in:

______ the same period of time?

______ a shorter period of time?

______ a longer period of time?

13. Does Mastery Learning work? (e.g.: What are its strengths and limitations? Is it necessary to make modifications because of particular circumstances, or becuase the theory does not coincide with reality, etc? Are there certain subjects or grades or students more/less suitable for Mastery Learning? Generally, what advice would you give to someone contemplating the adoption of the Mastery Learning approach?)

Appendix C: Tables from Survey Data

Table C1. Areas from which Responses Came

Canada	No.	United States	No.	Unknown	No.
Ontario	2	Colorado	6	U.S. (?)	3
Manitoba	2	South Carolina	4		
Nova Scotia	1	Illinois	2		
		Ohio	1		
		Oregon	1		

Table C2. Positions held by Respondents

Elementary		Secondary	
Position	No.	Position	No.
Teacher, K-8	5	Teacher	3
Principal	8	Principal	1
Coordinator	3	Vice-Principal	1
		Ph.D. Student (ex-teacher)	1

Table C3. Respondents' Years of Experience with Mastery Learning

Length of Time	No.
Less than 1 year	1
1-2 years	12
2-5 years	7
14 years	1
15 years	1

Table C4. Subjects and Grades Taught Using Mastery Learning

Subject	Elementary Grades	Secondary Grades
Social Studies	K-5	10-12
Mathematics	K-8	9-12
Handwriting	K-4	
Spelling	1-6	
Reading	1-5	
Music	5	
Physical Education	4-6	10
Health		9
Science		10
Chemistry		9-11
English		9-11

Table C5. Responses to Question: "Who made the decision to introduce mastery learning into your class/school/school system?"

Position	Response	No.
Elementary principals	Principal and staff	6
	Principal with individual teachers	1
	Former principal	1
Elementary teachers	Principal, staff, district office	1
	Principal, district office	1
	Teachers, district office	1
	Principal, teachers	1
Coordinators	Principal, staff, district office	1
	District office	2
Secondary principal	Former principal	1
Secondary vice-principal	Self (as teacher)	1
Secondary teachers	Self	2
	Administration	1

Table C6. Amount of Time Required to Prepare Curriculum

Position	Very Little	Moderate	Considerable
Elementary principals			3
Elementary teachers	1	1	3
Coordinators		1	1
Secondary vice-principal			1
Secondary teachers	1	1	2
Totals	2	3	10

Table C7. The Most Difficult Aspect of Mastery Learning

Position	Objectives	Standards	Tests	Correctives
Elementary principals			1	3
Elementary teachers	3	1	3	
Coordinator				1
Secondary vice-principal			1	
Secondary teachers	1	1	2	
Totals	4	2	7	4

Table C8. Methods and Materials Used As Correctives

Methods	No.	Materials	No.
Peer tutoring	6	Prepared worksheets	4
Games	5	Tapes	3
Group work	2	Charts	2
Drill	1	Filmstrips	1
Oral interview	1	Alternative texts	1

Table C9. Time Required to Cover Course Content, Relative to Previous Approach

Position	Shorter	Same	Longer
Elementary principals			3
Elementary teachers	1	2	3
Secondary principal/ vice-principal		2	
Secondary teacher		2	1
Totals	1	6	7

Appendix D: Samples of Units from the Chicago Mastery Learning Reading Program

Skills: FG (End of 2nd/beginning of 3rd)

TABLE OF CONTENTS

ACKNOWLEDGMENTS.....v
INTRODUCTION.....vii
UNIT 1.....1
Long Vowel Sounds: A and E
Alphabetizing
UNIT 2.....18
Base Words and Endings
Using the Dictionary
UNIT 3.....31
Long Vowel Sounds: I and O
Using Table of Contents
UNIT 4.....52
More Base Words
Context Clues
UNIT 5.....72
Long Vowel Sounds: U
Homonyms
Long Vowel Sounds: Review
UNIT 6.....87
Review of Base Words: Endings and Beginnings
Common Phonograms: -all, -ell, -ill
UNIT 7.....102
Synonyms
Common Phonograms: -igh, -ight
Using A Street Map
UNIT 8.....127
Common Phonograms: -old, -ild
Antonyms
UNIT 9.....139
Prefixes
Reading a Graph
UNIT 10.....163
Three Letter Blends: spl, shr, squ
Suffixes
UNIT 11.....186
Three Letter Blends: str, thr, spr
Words With More Than One Meaning
UNIT 12.....206
Silent Letters in Common Words
Using A Glossary
Unit 13.....221
Syllabication
Guide Words
Unit 14.....245
Syllabication Patterns
Stress Patterns

UNIT 9 (Skills)

PREFIXES

READING A GRAPH

PREFIXES

Initial Instruction

First Teaching Activity

Instructions for teachers:

I. Prefix "re-"

A. Explain to the students that a group of sentences will be read aloud to them. There is a familiar word in each one that has something added at the beginning that changes its meaning. As you read the sentences below aloud, write the underlined word on the board and ask the students if they know what it means. Help the class identify the root word in each case.

1. My boss fired me on Monday, but he rehired me on Tuesday.

   rehire - to hire again

2. Larry drank the milk from his glass and then asked his mother to refill it.

   refill - to fill again

3. When I didn't understand the story I had to reread it.

   reread - to read again

B. Help children generalize that the prefix "re-" means to do again or repeat. Since it is more difficult to recognize the root word when it doesn't come first, write this list of words one at a time and pronounce the root word before adding the prefix; then pronounce again.

do	redo	=	do again
teach	reteach	=	teach again
build	rebuild	=	build again
heat	reheat	=	heat again
name	rename	=	name again

PREFIXES

Initial Instruction

First Teaching Activity (cont'd)

II. Prefix "un-"

A. Explain that a new group of sentences will be read in which one word begins with the prefix or word part "un-". Ask the students to listen for and identify the words and see if they can decide what they mean. List the words as they are identified and ask what the root word is.

1. Andrew was unhappy because he lost the ball game.
2. Tom's sister is unmarried and says she wants to stay that way.
3. We took the unwanted kittens to the animal shelter.
4. For three weeks the workers were unpaid.

B. Lead the class to generalize that "un-" added to a word means something like not. (For example, the "uncola" means "not a cola".)

Write: unproved -- means not proved
Oral example: The charges against him were unproved.

Write: unloved -- means not loved
Oral example: I felt unloved when Mom made me go to bed without dinner.

Write: unsafe -- means not safe
Oral example: That car is so broken down, it's unsafe to drive it.

Write the following words on the board and have students supply the correct definitions:

opened	unopened means________________
wanted	unwanted means________________
plug	unplug means__________________

PREFIXES

Initial Instruction

First Teaching Activity (cont'd)

III. Prefix "dis-"

A. Explain that the last group of sentences will be read and that each contains a word that begins with the syllable or word part, "dis-". Ask students to listen carefully to identify the word and guess about the meaning.

1. My mother thinks kids should go to bed before 10:00 P.M., but I disagree.

   disagree - don't agree

2. When the basketball player hit the referee, he was disqualified from the game.

   disqualified - no longer qualified; not qualified to play. (This is a generally negative sense, but to reword the meaning depends on the individual word.)

3. The mounted policeman dismounted from his horse.

   dismounted - to get off (This is the reverse of mount, or to get on.)

4. Some people feel it's disloyal to find fault with your own family.

   disloyal - not loyal

B. Write these patterns on the board and review orally:

agree	disagree
connect	disconnect
approve	disapprove
loyal	disloyal

IV. Hand out Student Activity Sheet and work through it with students.

PREFIXES

Student Activity Sheet

A. Here are groups of words from your lesson that begin with prefixes. Underline the prefix as you read each word to yourself.

Example:	rehire	unloved	disagree
1.	reteach	unwanted	dismount
2.	reheat	unpaid	disconnect
3.	redo	unsafe	disloyal
4.	rename	unhappy	disapprove

B. Read each sentence below. Then look at the group of words to the right and decide which of the words best completes each sentence. Write the correct word in the blank provided.

1. a. When our cat named Tom had kittens, we wanted to ________________ it.
   b. My teacher couldn't read my writing so I had to ______________ it.
   c. The meat got cold, so we had to _________________ it.

reheat

redo

rename

---

2. a. The electric bill was ______________ so the lights were turned off.
   b. Jim felt ________________ because he forgot to bring his lunch to school.
   c. A car with no brakes is ___________.

unpaid

unsafe

unhappy

---

3. a. Are you _____________ if you don't salute the flag?
   b. I think the answer is correct, but maybe you will ____________.
   c. The policeman had to ___________ from his horse.

disagree

dismount

disloyal

READING A GRAPH

Initial Instruction

First Teaching Activity: Picture Graphs

A. Explain to students that there are many ways of giving information - in writing, in pictures, on tapes and records, etc. One very common way is a kind of combination of words and pictures, called a graph. There are many kinds of graphs and we will begin with one of the easy ones, a picture graph.

B. Explain that you will conduct a short survey so that you can make a graph together and show how two different kinds of information can be shown at one time on a graph.

1. Take a little survey. Ask kids to imagine that they are at McDonald's and they can all have a milk shake. Ask how many would like chocolate, how many strawberry, how many vanilla.
    a. chocolate =
    b. strawberry =
    c. vanilla =
2. You now have two sets of facts:
    a. flavors of ice cream
    b. numbers of kids who would choose each flavor.
3. Draw a large square on the board.
4. Explain that we want to show both sets of facts.
    a. We can write flavors down the side.
    b. Now we need a sign to stand for number of kids who chose each.

chocolate

strawberry

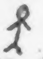
vanilla

What would be a good picture?

READING A GRAPH

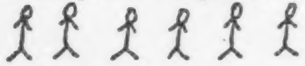
Initial Instruction

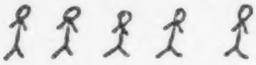
First Teaching Activity: Picture Graphs (Cont'd)

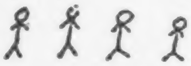
1) Could be a stick figure  ; a dot ● ; a star ☆ , or whatever. But if we have to use 1 picture for each student we have to draw a lot of pictures. So let 1 picture = 2 students.

2) Choose the symbol: for example, the stick figure.

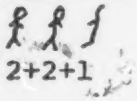
3) Now, if there are these numbers who like each flavor, how many figures would we draw for each. Stress counting by two's, that is, each figure represents two people.

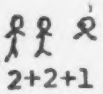
   a. chocolate = 12 

   b. vanilla = 10 

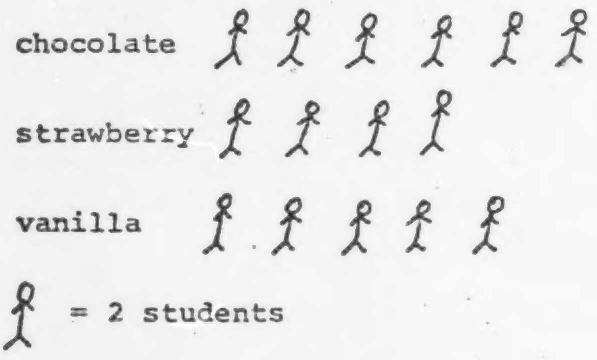
   c. strawberry = 8 

4) Ask what happens if there is an odd number. How might we show 5 people? Accept what seems sensible:

   a. 

   b. 

5) Now transfer your real figures to the graph on the board. Be sure that you note what the picture stands for, as you do on a map key. The graph might look like this.



6) What would be a good title for the graph? The title should tell what the graph is about.
Example: "Favorite Milk Shake Flavors of Room _____"

READING A GRAPH

Initial Instruction

First Teaching Activity: Picture Graphs (Cont'd)

7) Erase any numbers that may be on the board from your survey. Leave the graph. Then ask students to help find answers for these questions orally.

   a. What is the most popular flavor?
   Ask student to explain how he or she arrived at the answer from the graph.

   b. What is the least popular flavor?
   Ask student to explain why he or she thinks so. Remember that the student doesn't have to know how much less popular, but can see at a glance which is most popular and which is least popular by looking at the number of figures.

   c. How many students like chocolate?
   Ask any student to explain answer. Remember that each figure equals two students, not just one.

   d. How many students like strawberry?

   e. How many students like vanilla?

   f. Compare the numbers of students that like strawberry versus vanilla, vanilla versus chocolate, chocolate versus strawberry, etc., i.e., how many more students like chocolate than strawberry?

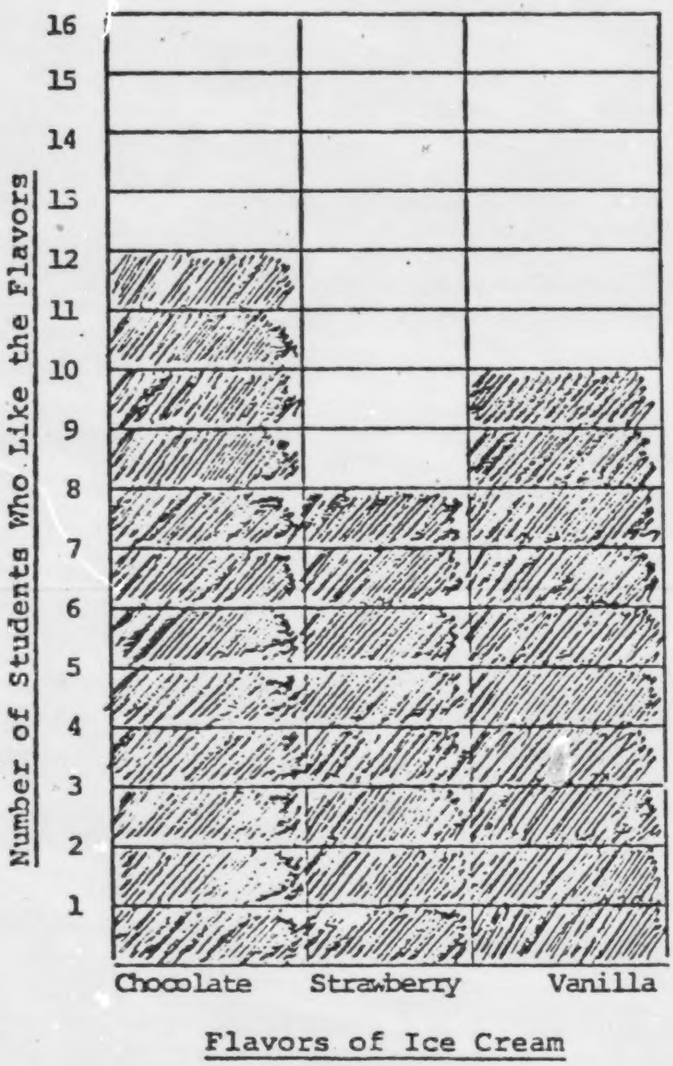
READING A GRAPH

Initial Instruction

Second Teaching Activity: Bar Graphs

A. Explain to the class that the information you gathered to make a picture graph can be used to make another easy kind of graph, a bar graph.

B. Rewrite the numbers of students who liked each flavor. Then draw the grid below on the board.



1. When deciding how many units high the bars should be, keep in mind the largest number you have to represent. If 20 students like vanilla, 8 like chocolate and 4 like strawberry, you will have to be able to represent 20. Lets assume the numbers are the same as before.

   a. chocolate - 12

   b. strawberry - 8

   c. vanilla - 10

   We have to be able to show 12 at the most.

2. If we want to show how many students like chocolate, we have to fill in 12 units. You can choose students to shade in the graph. Have them explain what they will do first, then shade.

3. Do the same thing with strawberry and vanilla.

4. Remind students that in this graph each shaded unit equals one student. Ask student volunteers to change the graph to show these values.

   a. chocolate - 15

   b. strawberry - 5

   c. vanilla - 12

READING A GRAPH

Initial Instruction

Second Teaching Activity: Bar Graphs (Cont'd)

5. Tell students that this time you will change the values or amount and students will write answers to these questions.

   a. How many students like chocolate? (Change value to 3).

   b. How many students like vanilla? (Change value to 16).

   c. How many students like strawberry? (Change value to 13).

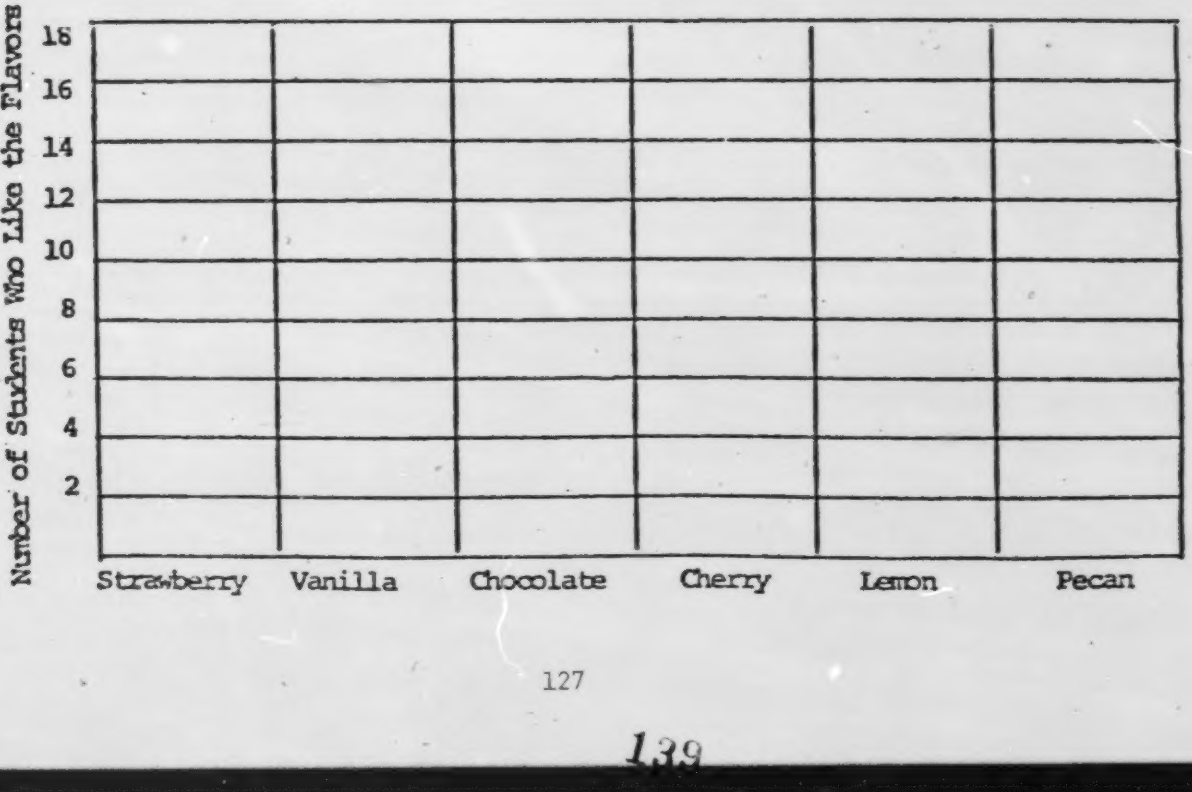
   d. Which is the most popular flavor?

   e. How many more kids like vanilla than strawberry?

   f. Which is the least popular flavor?

   g. How many more kids like strawberry than chocolate?

C. Erase the graph and rewrite it with different units so that 1 unit equals 2 students instead of 1. Explain what you are doing: that you are adding more flavors to make things a little more interesting. Ask volunteers to fill in the graph to a number of their own choice. Then have the class members tell how many children the graph indicates. Let your weaker students be the ones to fill in the graph because they will be able to make a contribution without having to come up with a "right" answer.



READING A GRAPH

Initial Instruction

Second Teaching Activity: Bar Graphs (Cont'd)

D. Once the graph is filled out, ask questions such as these and ask students to write answers independently. (Remind them that each unit represents 2 students now. Review a way to represent 1 student also - e.g., half of a square.)

1. What is the most popular flavor?

2. What is the least popular flavor?

3. How many students like each flavor?

4. How many like one flavor more or less than another?

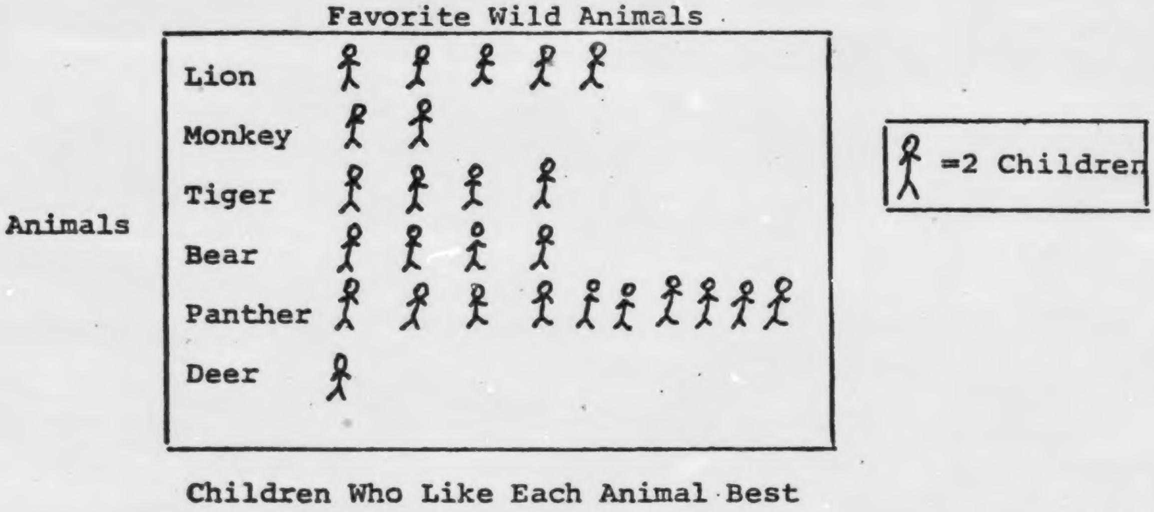
5. If you were only able to sell one flavor of ice cream, which would be the best flavor to choose?

E. Go over answers with students.

READING A GRAPH

Student Activity #1

I. Look at the picture graph below, then answer the questions.



A. Look at the key. How many children does each stand for?______

B. How many children like lions best?____

C. How many children like panthers best?____

D. How many children like monkeys best?____

E. Which is the animal the children like best?____

F. Which is the animal that the smallest number of children like best?____

G. How many more children like lions than monkeys?____

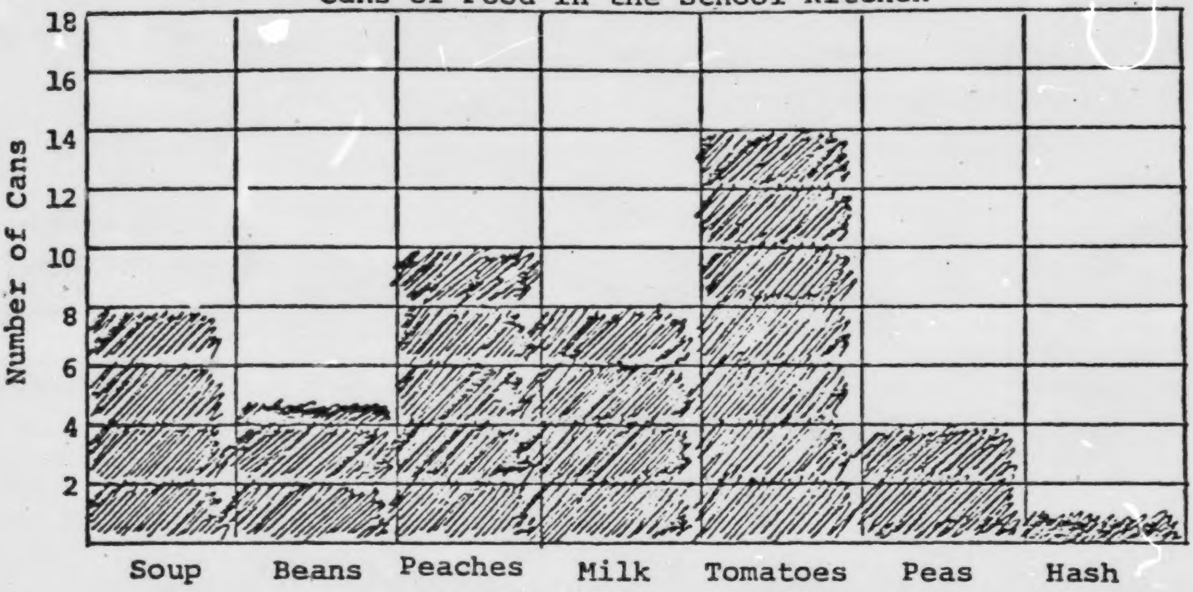
H. Which animals are liked best by the same number of children?____ and ____

II. Look at the bar graph on the next page. Then answer the questions.

READING A GRAPH

Student Activity #1 (Cont'd)

Cans of Food in the School Kitchen



Kinds of Canned Food

A. What kind of canned food does the kitchen have the most of?______

B. What kind of canned food does the kitchen have the least of?_____

C. How many cans are there of each of these kinds of food?__________

Soup_________

Beans_________

Peaches______

Milk_________

Tomatoes_____

Peas_________

Hash_________

Unit 9: FT

PREFIXES and READING A GRAPH

Formative Test

I. Read each sentence. Read the words beneath each sentence. Choose the correct word to go in each blank. Underline the correct answer.

Example: Dinner got cold, so mother had to __________ it.

require rename reheat

1. Sally didn't understand the story so she had to ________ it.

remake refill reread

2. It was too hot, so Alan had to _________ the heater.

unsafe unplug unpaid

3. It is _________ to drive a car with no brakes.

unwell unhappy unsafe

4. William felt very ________ when his dog ran away.

unkind unpaid unhappy

5. The boss ran out of money so his workers were _________.

undone unpaid unsafe

6. The paint job on the car was so bad it had to be ____________.

resold rehired redone

7. My father went to the gas station to _________ his car's tank.

rehire redo refill

8. My model airplane came apart so I had to _________ it.

reglue rewash repack

9. The ice cream melted so we tried to __________ it.

recook refreeze replay

10. We liked the story so much we asked to have it _________.

retold restrung reheated

PREFIXES and READING A GRAPH

Formative Test (cont'd)

11. The strong bleach caused the red blouse to fade and _________.

    discuss disagree discolor

12. My parents said they would _________ of my playing football instead of doing my homework.

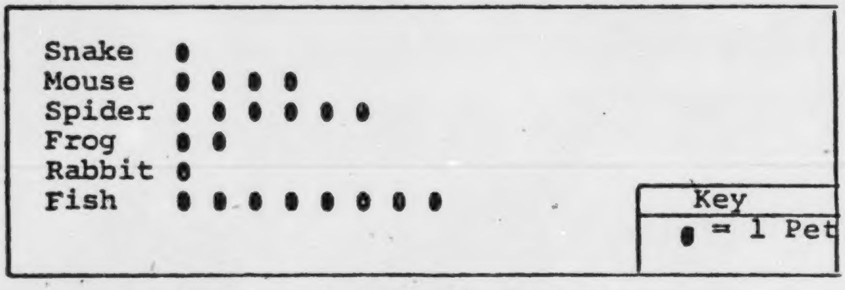
    disapprove disconnect disorder

13. When he didn't pay the bill for his telephone, the company threatened to _________ it.

    disloyal disconnect disappoint

II. Reading a picture graph: Look at the graph carefully and then answer the questions.

Pets In A Fifth Grade Class



Number of Each Kind of Pet

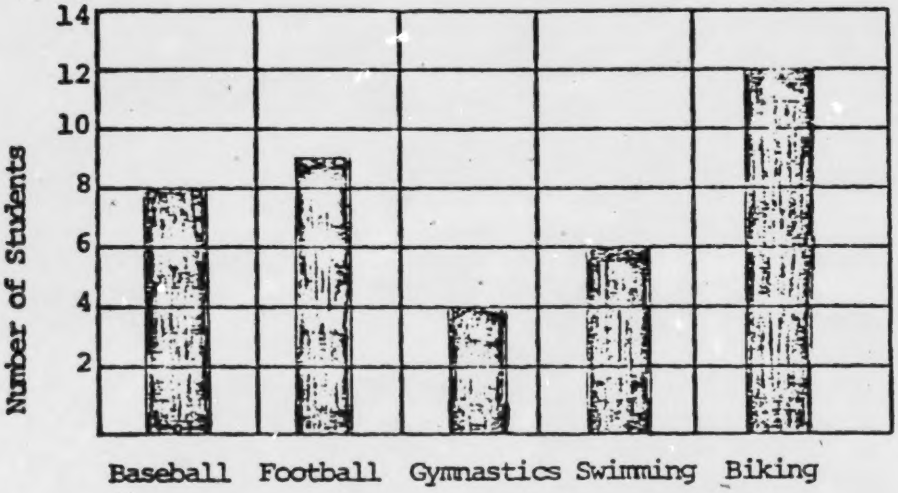
1. How many different kinds of pets are there?______
2. What is the pet the class has the most of?_________
3. What two pets does the class have the same number of? ________________________________
4. How many of each of the pets below are in the class?
    a. mouse = ____
    b. spider = ____
    c. frog = ____
    d. fish = ____
5. How many more spiders are there than mice?____

PREFIXES and READING A GRAPH

Formative Test (Cont'd)

III. Reading a bar graph: Look at the graph carefully and then answer the questions.

Favorite Sports of A Fifth Grade Class



1. What is the sport liked by the most kids in the class?____________

2. What is the sport liked by the least kids in the class?____________

3. How many students said each of these sports was his or her favorite?

   a. Baseball = _____
   b. Football = _____
   c. Gymnastics = _____
   d. Swimming = _____
   e. Biking = _____

4. How many more students like baseball than swimming?_____

PREFIXES

Additional Activity

Part I.

A. Cut out the prefix cards and root word cards on the word card sheet.

B. Match the prefix cards with the root word cards to make new real words. Sometimes, more than one prefix will go with a single root word to form a new word. Try to form as many new words as you can. If you are not sure that the word you come up with is a real word, see if you can find it in the dictionary before asking your teacher about it.

C. When all the matches sound right to you, ask your teacher to check your cards.

D. Write all the correct matches on the blank lines below.

____

____

____

____

____

____

____

Part II.

A. From the list of words you just created, try to find a different word to complete each of the following sentences.

B. If you can't find one to fit with a sentence, go back to the root-word and prefix cards to create a new word to fill in the blank.

PREFIXES

Additional Activity (Cont'd)

WORD CARD SHEET (see next page)

Root Word ____ fair	Root Word ____ loyal
Root Word ____ write	Root Word ____ fill
Root Word ____ cover	Root Word ____ tied
Root Word ____ paint	Root Word ____ appear
Root Word ____ prove	Root Word ____ connect

Prefix un-	Prefix re-	Prefix dis-

PREFIXES

Additional Activity (cont'd)

Fill in the blanks in the sentences below with the correct un- words.

1. It is ____________ for women to do the same work as men, but make less money.
2. The boy's shoelace came ______________ and he tripped over it.
3. The men dug underground to try to __________ a box of stolen gold.
4. It makes me __________ to see you cry.

Fill in the blanks in the sentences below with the correct re- words.

1. Your paper is so messy you will have to ____________ it.
2. The sofa is so dirty that we have to ___________ it with new cloth.
3. The gas in the car is so low we will have to ________ the tank.
4. The house is white, but I want to __________ it yellow.

Fill in the blanks in the sentences below with the correct dis- words.

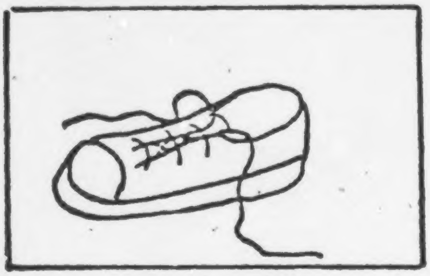
1. The magician made an elephant __________ before our very eyes.
2. The movie star tried to ___________ the rumor that she was leaving show business.
3. Because he would not help out with the family business, he was considered ___________.

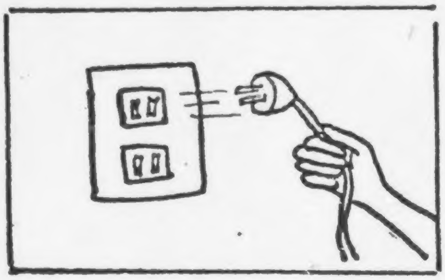
Ask your teacher to check your work.

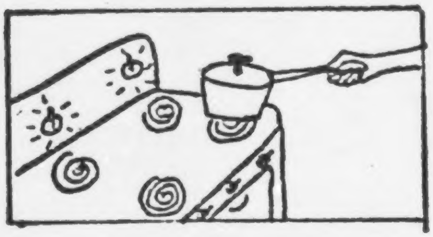
PREFIXES
Additional Activity (cont'd)

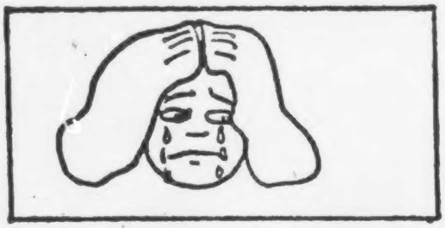
Part III.

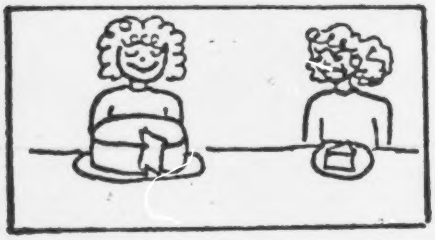
Match the correct word with the right picture. Write the correct word below the picture it goes with.

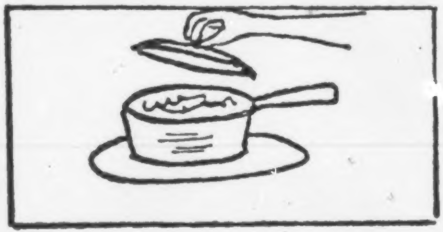


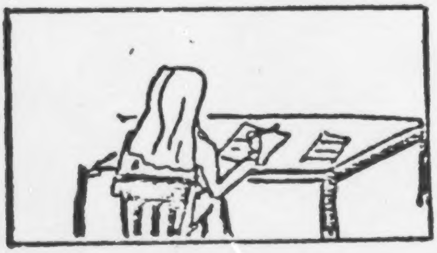


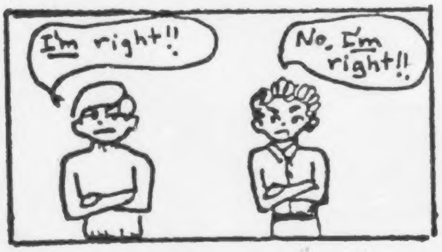


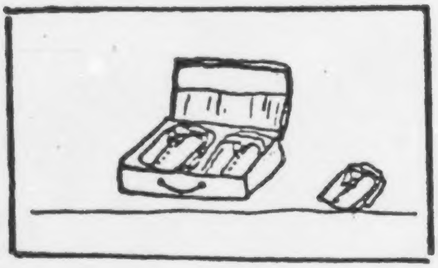


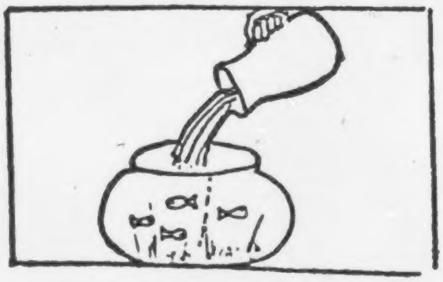







I'm right!!
No, I'm right!!





untied

unpack

unhappy

refill

reheat

disagree

unfair

disconnect

uncover

rewrite

PREFIXES

Additional Activity (cont'd)

Part IV

Look at the words below. Draw a circle around the prefix in each word, and then underline the root word.

Example: redo

rehire
unbroken
unbutton
redo
dismount
unhappy
disapprove
disconnect
unfair
rename
rerun
reuse
unopened
unstuck
disagree

Unit 9: AA-2-1

READING A GRAPH

Additional Activity

I. Here is a little story for you to read. When you are finished you will complete the picture graph below to show what you have found out. Read the story carefully.

Ann is just crazy about ice cream. On Monday she ate four ice cream cones. On Tuesday she ate three ice cream cones. On Wednesday she was feeling too sick to eat any ice cream at all but on Thursday she ate six ice cream cones. Then her friend Tom said, "I'll bet you can't eat ten ice cream cones all at once." So, on Friday, Ann ate ten ice cream cones at lunch time. She is the champ of all time.

II. Here is a chart that shows the days of the week. Here is the picture to show that one ice cream cone was eaten. (🍦) Read to find out how much ice cream Ann ate on each day and draw an ice cream cone to stand for each one she ate on each day.

Days When Ann Ate Ice Cream Cones

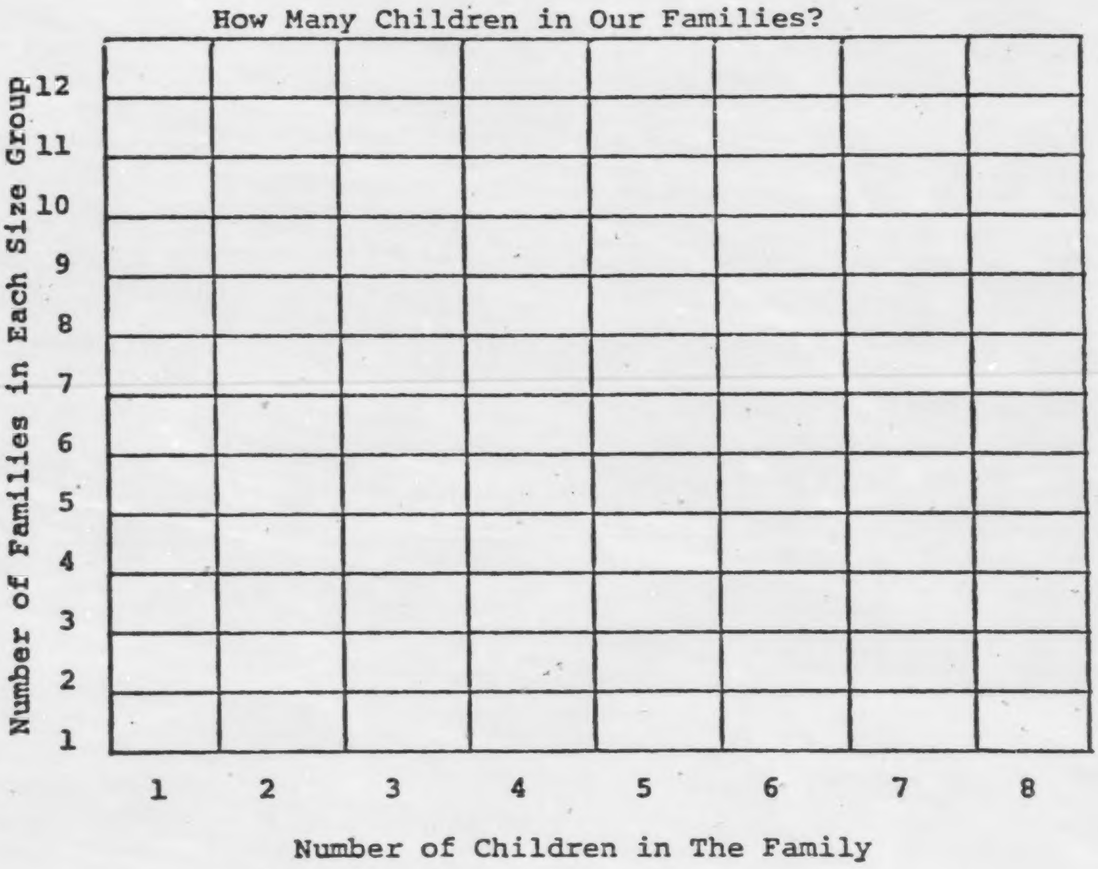
Friday	
Thursday	
Wednesday	
Tuesday	
Monday	

Number of Ice Cream Cones on Each Day

READING A GRAPH

Additional Activity (Cont'd)

III. Here is a bar graph for you to fill out. It shows how many children there are in the families of the students in a fifth grade class. This time, every step up on the bar graph stands for one family with the number of children shown on the graph.



How Many Children in Our Families?

A. Shade in the graph to show these facts:

1. 6 families have only one child.
2. 12 families have two children.
3. 8 families have three children.
4. 3 families have four children.
5. 1 family has five children.
6. 1 family has eight children.

READING A GRAPH

Additional Activity (Cont'd)

B. Answer these questions about the graph you have just made. Underline the right answer:

1. Most students in this class come from families with

   a. One Child b. Two Children c. Three Children
   d. Four Children

2. Only ____ student(s) in this class come from a family with eight children.

   a. One b. Two c. Three

3. ______student(s) in this class come from families with seven children.

   a. Zero b. One c. Two

4. *By looking at this graph we can see that in this fifth grade class:

   a. Larger families are more common than smaller families.

   b. Smaller families are more common than larger families.

5. By looking at this graph we can see that in this fifth grade class:

   a. Most families have one or two children.

   b. Most families have two or three children.

   c. Most families have three or four children.

---

* a small family in this exercise is considered to be no more than two children.

TABLE OF CONTENTS

ACKNOWLEDGMENTS....................................v
INTRODUCTION.....................................vii

UNIT 1...1
Categorizing

UNIT 2...14
Comparisons Part I

UNIT 3...26
Making Sense

UNIT 4...39
Comparisons Part II

UNIT 5...48
Picking the Best Answer

UNIT 6...65
Comparisons Part III

UNIT 7...73
Reading For Detail

UNIT 8...84
Cause And Effect Relationships

UNIT 9...96
Fact And Opinion

UNIT 10..106
Finding The 'Right' Answer

154

UNIT 1 (Comprehension)

CATEGORIZING

155

CATEGORIZING

Initial Instruction

First Teaching Activity

Instructions to teachers:

A. The purpose of these activities is to clarify ways that students may group objects into separate categories. The concept "category" may be explained to students as a division of things into groups, with a name or label which tells how they are all alike in some way. Write the following words on the blackboard:

corn banana apple peach roast beef

cake grapes milk hamburger bread

Explain to students that this is a division of things into a category. Ask them what name or label should be used for this category to elicit the label "food". Write the second group of words on the blackboard:

leopard cat bird horse cow

pig fox fish duck tiger

Again, ask pupils to supply a category label to name this group of things which is alike in some way by asking pupils how they are "similar" to elicit the category "animals".

B. Tell students that today we will read a story about animals, past and present, and that in the exercise which follows the story, we'll be asked to divide animals into categories which show how they are alike in some way. As we group the animals we'll fit them into categories by asking what kind of skin they have, and where they live or spend most of their time.

Some animals have feathers (birds), others have scales (fish), and still others have fur or hair (mammals). Some animals live on land, some in water, and others spend most of their time in the air.

It is also important to remember that there are always exceptions in every group. That is, those which do not fit the rule.

C. Before the children read the story, "Animals, Past and Present", introduce the words prehistoric, extinct, fossil, dinosaur, mammal and replica. The story explains the meaning of these words. Also, write Tyrannosaurus Rex, Ichthyosaur and Pterodactyl on the blackboard. These are the names of the three dinosaurs.

CATEGORIZING

Initial Instruction

First Teaching Activity (cont'd)

which they will read about in the story. Review the pronunciation of these words, and introduce any other words which might not be in the children's basic vocabulary, such as resemble and tremendous. Encourage pupil's to use the dictionary as an aid to discovering word meanings and pronunciations.

CATEGORIZING

Student Activity Sheet #1

Animals, Past and Present

Did you know that animals have been around the earth for a very long time? How long do you think? Would you believe for about 350 million years? If you have ever been to the Chicago Field Museum, you have seen one of the very earliest animals that lived on earth. He is very, very big. He stands about 40 feet tall! You can't miss him as you walk in the front door of the museum. Although he's big, and looks as though he could devour you, he's actually very quiet. He's not alive, and neither is any animal like it alive today. You could say that he is extinct. This means that no animals of his type or species are still being born, or will probably ever exist again.

He is also called a prehistoric animal. He lived before man began to make a written record about what was happening on earth. Some of the very early prehistoric animals are called dinosaurs. These are very large lizard-like animals.

The Tyrannosaurus Rex (tə-ran-ə-sor-əs reks) was the largest meat-eating dinosaur that ever lived on land. His name means "master lizard". From the top of his head to the tip of his tail, he could grow to nearly fifty feet long. He weighed up to 12 tons, larger than even the largest elephant. His short front legs and his large hind legs made him resemble a tremendous lizard.

The dinosaur at the entrance of our Field Museum is a replica of this type of dinosaur. A replica is a close copy of something. But, if dinosaurs are prehistoric animals and are extinct, how do we know what they really looked like? Man has found fossils, parts of plants or animals sealed within the earth which still reveal what life resembled many years ago. Using these fossils man has been able to draw or make replicas of animals which lived in the past.

Another animal from prehistoric times is the Ichthyosaur (ik-thē-ə-so(ə)r). Its name means "fish lizard". This is an extinct animal which lived in the water like a fish does, and which also was shaped like a fish.

A third prehistoric animal was the Pterodactyl (ter-ə-dak-t-l). Its name means "wing lizard". Some of these animals had wings that, when stretched out wide, measured 25 feet from end to end. These were the largest flying animals that ever existed. Can you imagine how you would feel if you were walking home and one flew over your head landing on the sidewalk in front of you? Never fear, these animals are also extinct. These are all animals of the past.

CATEGORIZING

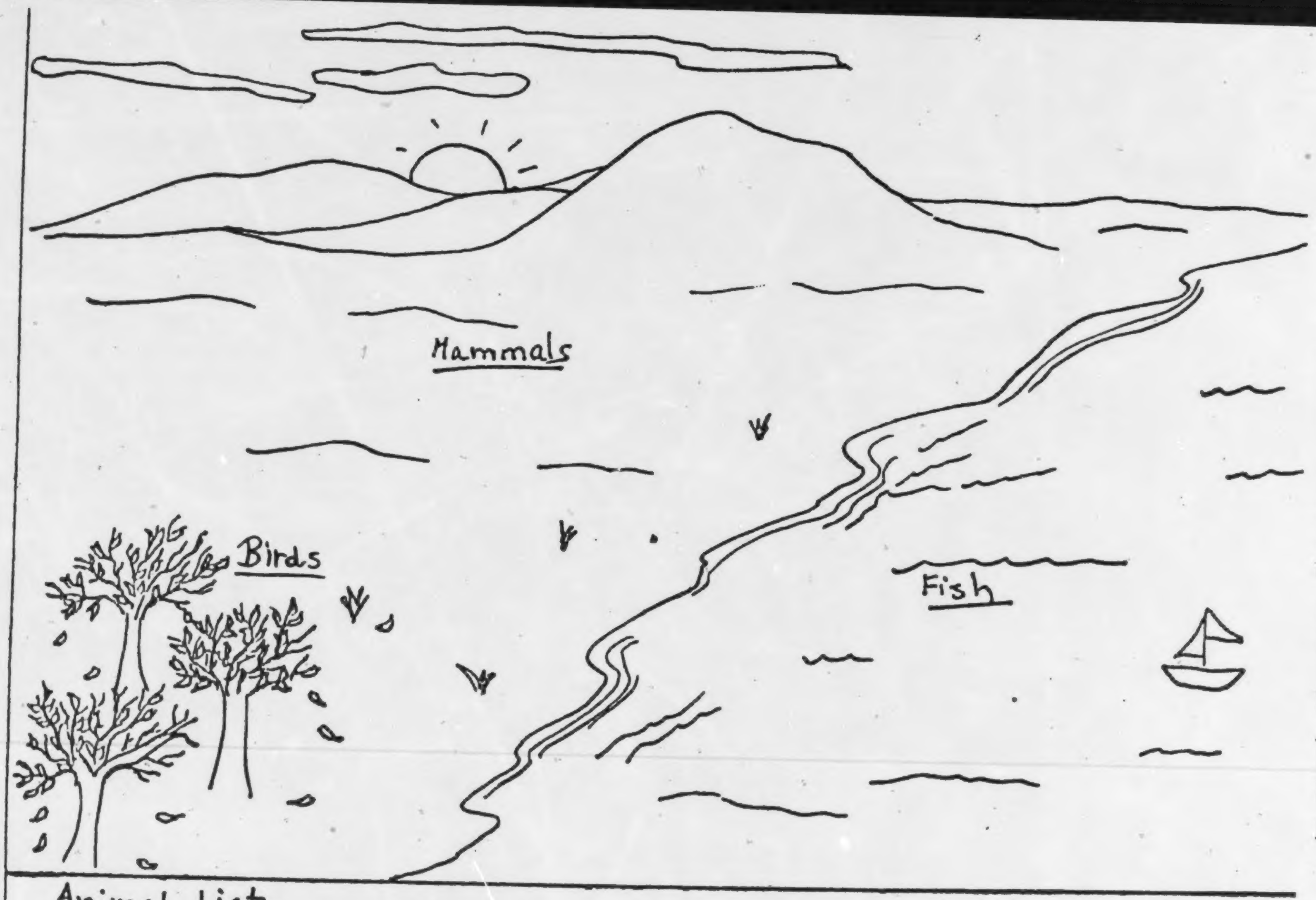
Student Activity Sheet #1 (cont'd)

There are many animals living on our earth today. Some live on land or in the water, others fly in the air. You will be given a list of animals which live on our earth today. We can divide this list of animals into categories which show that they have something in common. Some of these animals belong to a category called mammals. They feed their young babies with milk, have hairy skins and live on land (the group of water mammals are an exception to this, including dolphins and whales). Another category called fish live in water and have scaly skin. The third category, birds, have feathers and wings and usually can fly in the air (an exception is the ostrich, a bird so large that he is unable to fly. The ostrich may weigh up to 300 lbs).

Look at the activity sheet that follows on the next page. An animal list is provided and three categories are pictured in the drawing. To what category does each of the animals in the list belong? How can you tell whether it is a mammal, a fish or a bird, or what the animal name means? Refer to the story, "Animals, Past and Present" or to the dictionary if you aren't sure. Then put each animal's name under the correct category in the drawing.

CATEGORIZING

Student Activity Sheet #1 (cont'd)



Animal List:

horse
shark
zebra
barracuda
ostrich
pig
robin
herring
eagle
eel
sparrow
tiger
mouse
duck
salmon

CATEGORIZING

Initial Instruction

Second Teaching Activity

Instructions to teachers:

A. Chart-making is a method of concisely organizing and categorizing information. In the first teaching activity students were asked to categorize information by utilizing one set of criteria to determine whether a specific animal belongs to a group called birds, fish or mammals. In these chart-making activities which follow, students will be asked to group animals again using the previously studied criteria, plus one additional criteria, such as whether the animal is large or small, or whether the animal is generally used for food or not.

Explain to students that this lesson will deal with ways of categorizing or grouping animals. Ask students to think about how they grouped their list of animals in the previous lesson as birds, fish or mammals. Review with them the set of criteria for determining the group to which each animal belongs.

B. Write the following list of animal names on the blackboard:

Animal List

mouse
elephant
guppy
robin
hippopotamus
shark
pigeon
barracuda
goldfish
eagle
hamster
ostrich

Then draw this diagram on the blackboard:

Animals	LARGE	SMALL
Birds		
Fish		
Mammals		

CATEGORIZING

Initial Instruction

Second Teaching Activity (cont'd)

Point out to pupils that you have made a chart which will answer two types of questions about the animals from the animal list. First, what kind of animal is it (a bird has feathers and wings and normally can fly in the air; a fish usually has scales and lives in water; and a mammal is a land-loving furry or hairy animal)? Next, what size is it, is it an animal which is small, or is it a large animal?

Pronounce the animal names on the list, and allow pupils to comment about them or to describe them if they are not familiar to all the students.

Fill in the chart on the blackboard as a group activity. Discuss why each animal fits into a particular slot in the chart by meeting two criteria which tell what type of animal it is (bird, fish or mammal) and what size it is (large or small).

C. Explain to pupils that you will ask them to categorize animals again. This time they will have to decide what type of animal it is, bird, fish or mammal, and whether we generally use it for food or not.

Before beginning the chart which follows, discuss farming and fishing with students. Explain that fisherman capture seafood, and that farmers raise vegetables, fruits and animals for us to eat. Explain how cattle and sheep are domesticated and raised for food by ranchers.

Ask pupils to name some animals which are not used for food. Point out that many insects and wild animals are not generally consumed as food in this country, but may be eaten by a few people here, and may be a popular food elsewhere. Some examples: fried ants, snails (escargot), shark and horse meat.

Explain to pupils that on the chart which they will do next (Student Activity Sheet #2), the animals will be divided into the bird, fish and mammal categories and into two additional categories; animals used for food, and wild animals, animals not generally kept on farms or ranches, or sold in most grocery stores as food.

Pronounce and review the words from the animal list. In classes needing guidance in the activity each choice can be discussed by students together, then written on their own charts after the appropriate responses have been decided and agreed upon by all.

Students may also fill out their charts independently, then check their work by filling out the same chart on the blackboard as a group.

Animals	Animals Used For Food	Wild Animals
Birds		
Fish		
Mammals		

Animal List

canary
eel
cow
hawk
chicken
salmon
skunk
trout
duck
shark
rabbit
elephant
piranha
sheep
pheasant
eagle
bass
bluebird

Unit 1 FT

CATEGORIZING

Formative Test

Directions:

Read the paragraph and complete the exercise which follows:

GOING CAMPING

One day three brothers, Ronnie, Anthony and Robert began planning a camping trip. They had to decide what to take and who was going to get it all together. Ronnie was especially interested in the kinds of equipment they should take, so he said, "We have to have the right equipment, so I'll collect it, because I'm the only one smart enough." Anthony didn't care about that; what he liked was eating. "I'll get the food and cooking stuff, so we don't starve." Robert was most interested in not freezing. "I will be the one to get something to keep us warm."

These are some of the things that they finally took on their trip:

tent
blankets
flour
bread
flashlight
fishing rod
pots and pans
rope
sweaters
milk
kerosene lamp
matches
water
canteen
raincoats
sleeping bags
knife
hats

List each of these below the name of the person who brought it on the camping trip. Note that some things may fit into more than one category. One thing has already been filled in under each name. You are to complete the lists for each boy.

Ronnie	Anthony	Robert
kerosene lamp	bread	sweaters

CATEGORIZING

Formative Test (cont'd)

Jim and Peter are brothers who share a room together. They both have many clothes and a big collection of games to play. They have games for indoors and outdoors and clothes for indoors and outdoors. Here is a list of some of the clothes they have and some of the games played by the two brothers.

Read the list through and then put each item where it belongs on the chart.

- Monopoly
- checkers
- bathrobe
- snow boots
- soccer ball
- raincoat
- hockey stick
- slippers
- galoshes
- football
- chess set
- pajamas
- baseball bat

	GAMES	CLOTHES
indoors		
outdoors		

CATEGORIZING

Additional Activity Sheet #1

I. Look at each group of four things listed in the boxes below. Three things in each group should be together because they are alike in some way. One does not belong with the others. Put a line through the one which doesn't belong in the same category as the others. The first one is done for you.

1. doll kite yo-yo ~~peach~~ toys	2. goldfish cow shark eel ________	3. balloon dress coat pants ________
4. tricycle book motorcycle bus ________	5. brick corn carrots apple ________	6. house apartment clock igloo ________
7. sparrow bluebird kangaroo pigeon ________	8. four 9 III Sally ________	9. crayon eraser chalk pencil ________

II. Look at these boxes given above. Then choose the correct category label which tells how these things are alike and why they are grouped together. Write the correct category label on the line below the list in each box.

Category Labels:

food

numbers

clothes

birds

toys

fish

things used for writing

things you ride

places where people live

CATEGORIZING

Additional Activity Sheet #2

MOVING DAY

The Johnsons are moving to a new apartment. Mrs. Johnson and Mary are getting ready to pack. "Let's put things into piles," said Mrs. Johnson. "Everything that is used in the kitchen should be put in one pile, clothes that belong to the children in one pile, and toys in a third pile."

Mary thought that sounded like a good idea and would be fun. "I will make three labels," she said. "One will say Playthings, another will say Clothing, and the third Kitchen Utensils.

Here are some of the things Mary and Mrs. Johnson put into the three piles:

electric train
sweaters
spoons
caps
kite
plates
tea kettle
socks
sled
jump rope
serving platter
mittens
shoes
raincoat
knives
mixing bowls
coats
roller skates
checkers
doll
pants
marbles
measuring cup
spoons

Below are Mary's labels. Under the label, write all of the things from the list that Mary and Mrs. Johnson should put into that pile:

Playthings	Clothing	Kitchen Utensils